PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 04 November 1999 (04.11.99)	
International application No. PCT/FI99/00214	**Applicant's or agent's file reference** AK/14270 WO
International filing date (day/month/year) 18 March 1999 (18.03.99)	**Priority date** (day/month/year) 18 March 1998 (18.03.98)
Applicant HÄNNINEN, Timo et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

06 October 1999 (06.10.99)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Jean-Marie McAdams
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

JOHANSSON, Folke
Nokia Corporation
P.O. Box 319
FIN-00045 Nokia Group
FINLANDE

Date of mailing (day/month/year)	
13 April 2000 (13.04.00)	
Applicant's or agent's file reference AK/14270 WO	**IMPORTANT NOTIFICATION**
International application No. PCT/FI99/00214	**International filing date** (day/month/year) 18 March 1999 (18.03.99)

1. The following indications appeared on record concerning:

[ ] the applicant [ ] the inventor [X] the agent [ ] the common representative

Name and Address	State of Nationality	State of Residence
JOHANSSON, Folke Nokia Corporation P.O. Box 226 FIN-00045 Nokia Group Finland		
	Telephone No. +358-9-18071	
	Facsimile No. +358-9-1807 593	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [ ] the name [X] the address [ ] the nationality [ ] the residence

Name and Address	State of Nationality	State of Residence
JOHANSSON, Folke Nokia Corporation P.O. Box 319 FIN-00045 Nokia Group Finland		
	Telephone No. +358-9-51121	
	Facsimile No. +358-9-511 64604	
	Teleprinter No.	

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Aino Metcalfe
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

JOHANSSON, Folke
Nokia Corporation
P.O. Box 319
FIN-00045 Nokia Group
FINLANDE

Date of mailing (day/month/year) 08 May 2000 (08.05.00)	
Applicant's or agent's file reference AK/14270 WO	**IMPORTANT NOTIFICATION**
International application No. PCT/FI99/00214	**International filing date** (day/month/year) 18 March 1999 (18.03.99)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address	State of Nationality	State of Residence
NOKIA TELECOMMUNICATIONS OY Keilalahdentie 4 FIN-02150 Espoo Finland	FI	FI
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [X] the name [ ] the address [ ] the nationality [ ] the residence

Name and Address	State of Nationality	State of Residence
NOKIA NETWORKS OY Keilalahdentie 4 FIN-02150 Espoo Finland	FI	FI
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Aino Metcalfe
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

REC'D 27 JUN 2000
WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
AK/14270 WO		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/FI99/00214	18/03/1999	18/03/1998
International Patent Classification (IPC) or national classification and IPC H04Q7/30		
Applicant NOKIA NETWORKS TELECOMMUNICATIONS OY et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of six sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
06/10/1999	23.06.00
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Rabe, M Telephone No. +49 89 2399 8801

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/FI99/00214

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-19	as published

Claims, No.:

1-19	as received on	21/03/2000	with letter of	16/03/2000

Drawings, sheets:

1/9-9/9	as published

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims 1-19
	No:	Claims
Inventive step (IS)	Yes:	Claims 1-19
	No:	Claims
Industrial applicability (IA)	Yes:	Claims 1-19
	No:	Claims

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Reference is made to the following document:

D1 = WO 95/33348

A. Citations and explanations made in respect of paragraph V:

1. The present invention relates to a **communication system**, to a corresponding **network element** in a communication system, and to a corresponding **method** for communicating in a communication system according to the features of respective independent **claims 1, 9, 14 and 18**.

2. **Generally**, in the past, separate networks have been deployed to handle traditional voice, data and video traffic, each with different transport requirements and each needing a separate terminal. In order to overcome the disadvantages of high costs and complexity thereof, efforts have been made to integrate different networks. In this respect, dual-mode phones have been suggested which access a local private network (eg. DECT) while in the office and a public network (eg. GSM) when outside of the office; the numbers can be mapped so that a subscriber can be reached using a single number.

   Document **D1** discloses a **communication system** comprising a mobile switching system, a **first subsystem** comprising one or more base stations for communicating with mobile terminals via an air interface, and a **second subsystem** comprising one or more base stations for communicating with the mobile terminals via an air interface and being accessible by a first group of mobile subscribers of the communication system, and comprising an **interworking function** for interconnecting the first and second subsystems, and **means for mapping** a number identifying a mobile subscriber in the communication system to a network address of the second subsystem when the mobile terminal of the mobile subscriber is able to communicate with a base station of the second subsystem.

3. A main **disadvantage** related to the system of document **D1** is that a particular interworking function (for transforming signals from one system (DECT) into signals of another system (GSM) and vice versa) must be provided between the first

and second subsystems to enable calls between separate base stations of the different subsystems, this increasing costs (eg. for intercompany calls) and complexity of the system.

4. The **present invention** overcomes these disadvantages by providing a **communication system**, a corresponding **network element** in a communication system, and a corresponding **method** for communicating in a communication system according to the features of respective independent **claims 1, 9, 14 and 18**.

According to the **essential features of the invention**, the communication system of the above known type further comprises one or more **first network elements** for **transforming** signals from the network switching system into **data packets** of the second subsystem and for **transforming data packets** from the second subsystem into signals of the network switching system, one or more **second network elements**, connected with one or more base stations of the second subsystem, for **transforming** signals from the base station of the second subsystem into **data packets** of the second subsystem and for **transforming data packets** from the second subsystem into signals to the base station of the second subsystem, and **means for delivering** data packets in the second subsystem according to a network address assigned to the first and the second network elements of the second subsystem.

According to **particular embodiments** of the present invention, the **network element** in the communication system of the present invention either comprises a **number of interfaces** to collect and store permanent and variable subscriber information of a subscriber of the first group from the mobile switching system and the second subsystem (claim 9), **or** it comprises **means for querying** from another network element the network address of the network element of the second subsystem connected to the base station the mobile terminal is currently able to communicate with (claim 14).

5. By including the first and second network elements in the communication system, signals from the MSC are transformed into data packets (and vice versa) which are sent over the delivering means (such as IP-based network or LAN) to another MSC or base station, thereby providing the **advantage** of reducing costs in inter-

company calls and more efficient use of the communication system.

6. The subject-matter of the present invention as claimed in respective independent claims 1, 9, 14 and 18 is neither disclosed in, nor rendered obvious by the remaining **prior art document** (ie. GB-A-2 269 723) cited in the international search report since said document, which merely relates to a very general state of the art of mobile radiotelephony and corresponding routing of calls between DECT- and GSM-based systems, does **not** describe the communication system, network elements or method according to the particular feature combination of the present invention or part thereof as defined in said respective independent claims 1, 9, 14 and 18.

7. The subject-matter of respective independent claims 1, 9, 14 and 18 therefore is considered to be **new** and to **involve an inventive step**, Article 33 (2) and (3) PCT.

8. As **claims 2 to 8, 10 to 13, 15 to 17 and 19** are dependent on respective claims 1, 9, 14 and 18, said claims 2 to 8, 10 to 13, 15 to 17 and 19 do **also meet** the requirements of Article 33 (2) and (3) PCT.

9. The present invention is **susceptible of industrial application**, Article 33 (4) PCT.

B. Remarks made in respect of paragraph VII:

1. To meet the requirements of Rule 5.1 (a) (ii) PCT, the cited document **D1** which represents a relevant prior art in respect of the present application, should have been identified in the opening part of the description and the relevant background art disclosed therein should have been briefly discussed.

2. To meet the requirements of Rule 6.3 (b) PCT, any independent claim should have been correctly cast in the **two-part form**, with those features which in combination are part of the nearest prior art (ie. document D1) being placed in

the preamble.

3. The opening part of the description should have been brought into conformity with the wording of the amended independent claims 1, 9, 14 and 18, Rule 5.1 (a) (iii) PCT.

C. **Remarks made in respect of paragraph VIII:**

The following amendment would have been necessary to the **claims**:

The various definitions of the network element given in independent claims 9 and 14 are such that the claims as a whole are **not concise**, contrary to Article 6 PCT. Moreover, **lack of clarity** of the claims as a whole arises, since the plurality of independent claims in the method category makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection.

The claims therefore should be recast to include only the **minimum necessary number of independent claims** in any one category, with dependent claims as appropriate (Rule 6.4 (a)-(c) PCT).

In the present case it is considered appropriate to use **only one** independent claim relating to the network element.

Claims

1. A communication system, comprising a network switching system (MSC) and a first subsystem (BSS) comprising one or more base stations (BTS) for communicating with mobile terminals (MS) via an air interface; and a second subsystem (WIO, BTS) comprising one or more base stations (BTS) for communicating with the mobile terminals (MS) via an air interface, said second subsystem (WIO, BTS) being accessible by a first group of mobile subscribers of the communication system, and comprising;

one or more first network elements (AGW; IGW) for transforming signals from the network switching system (MSC) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals of the network switching system (MSC),

one or more second network elements (IMC), connected with one or more base stations (BTS) of the second subsystem (WIO, BTS), for transforming signals from the base station (BTS) of the second subsystem (WIO, BTS) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals to the base station (BTS) of the second subsystem (WIO, BTS);

means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) according to a network address assigned to the first and the second network elements of the second subsystem (WIO, BTS); and

means (ILR, GK) for mapping a number identifying a mobile subscriber in the communication system to a network address of the second subsystem (WIO, BTS) when the mobile terminal of the mobile subscriber is able to communicate with a base station (BTS) of the second subsystem (WIO, BTS).

2. A communication system according to claim 1 wherein said second subsystem (WIO, BTS) comprises means (GK, ILR) for routing a call between subscribers of the first group within the second subsystem (WIO, BTS), as a response to each of the numbers identifying said mobile subscribers in the communication

system having a mapping to a network address of the second subsystem (WIO, BTS).

3. A communication system according to claim 1 wherein said second subsystem (WIO, BTS) comprises a subscriber register (ILR) for storing location information of a subscriber of the first group, said location information comprising data about the network address of the network element connected to the base station the mobile terminal of the subscriber is currently able to communicate with.

4. A communication system according to claim wherein said means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) comprise an IP Protocol network.

5. A communication system according to claim 4 characterised by the first group of mobile subscribers comprising employees of an office given an access to said IP Protocol network.

6. A communication system according to claim 1 wherein said means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) support H.323 standard.

7. A communication system according to claim 2 wherein said means (GK, ILR) for routing a call between subscribers of the first group within the second subsystem (WIO, BTS) are arranged to page locally calls originating from or terminating to a terminal of a subscriber of the first group.

8. A communication system according to claim 2 wherein said means (GK, ILR) for routing are arranged to route the call to the network switching system (MSC), as a response to not fulfilling either of the following conditions: each of the subscribers belong to the first group, a number identifying each of said

subscribers in the communication system have a mapping to a network address of the second subsystem (WIO, BTS).

9. A network element (ILR) in a communication system, comprising a network switching system (MSC) and

a first subsystem (BSS) comprising one or more base stations (BTS) for communicating with mobile terminals (MS) via an air interface; and

a second subsystem (WIO, BTS) comprising one or more base stations (BTS) for communicating with the mobile terminals (MS) via an air interface, said second base station subsystem (WIO, BTS) being accessible by a first group of mobile subscribers of the communication system, and comprising;

one or more first network elements (AGW; IGW) for transforming signals from the network switching system (MSC) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals of the network switching system (MSC),

one or more second network elements (IMC), connected with one or more base stations (BTS) of the second subsystem (WIO, BTS), for transforming signals from the base station (BTS) of the second subsystem (WIO, BTS) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals to the base station (BTS) of the second subsystem (WIO, BTS);

means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) according to a network address assigned to the first and the second network elements of the second subsystem (WIO, BTS); and

said network element (ILR) comprising a number of interfaces to collect and store permanent and variable subscriber information of a subscriber of the first group from the network switching system (MSC) and the second subsystem (WIO, BTS).

10. A network element (ILR) according to claim 9 wherein said variable information comprises the network address of the network element (IMC) of the

second subsystem (WIO, BTS) connected to the base station (BTS) the mobile terminal (MS) the subscriber is currently able to communicate with.

11. A network element (ILR) according to claim 10 wherein the element (ILR) is arranged to collect and store the subscriber information at least during signalling between the base station (BTS) and the mobile terminal (MS) for location update of said subscriber to the second subsystem (WIO, BTS).

12. A network element (ILR) according to claim 9 arranged to send, as a response to a query from another network element (GK), said subscriber information.

13. A network element (ILR) according to claim 9 said interfaces comprising a MAP interface between the network element and at least one of the following: Home Location Register (HLR) of a GSM network, Visitor Location Register (VLR) of a GSM network.

14. A network element (GK) in a communication system, comprising a network subsystem (MSC) and

a first subsystem (BSS) comprising one or more base stations (BTS) for communicating with mobile terminals (MS) via an air interface; and

a second subsystem (WIO, BTS) comprising one or more base stations (BTS) for communicating with the mobile terminals (MS) via an air interface, said second base station subsystem (WIO, BTS) being accessible by a first group of mobile subscribers of the communication system, and comprising;

one or more first network elements (AGW; IGW) for transforming signals from the network switching system (MSC) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals of the network switching system (MSC),

one or more second network elements (IMC), connected with one or more base stations (BTS) of the second subsystem (WIO, BTS), for transforming signals from the base station (BTS) of the second subsystem (WIO, BTS) into data packets of the second subsystem (WIO, BTS) and for transforming

data packets from the second subsystem (WIO, BTS) into signals to the base station (BTS) of the second subsystem (WIO, BTS);

means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) according to a network address assigned to network elements of the second subsystem (WIO, BTS); and

said element comprising means for querying from another network element (ILR) the network address of the network element (IMC) of the second subsystem (WIO) connected to the base station (BTS) the mobile terminal (MS) the subscriber is currently able to communicate with.

15. A network element according to claim 14 wherein the network element is arranged to implement functions of a H.323 Gatekeeper.

16. A network element (GK) according to claim 14 characterised by means (116) for mapping a number identifying a mobile subscriber in the communication system to a network address of the second subsystem (WIO) when the mobile terminal of the mobile subscriber is able to communicate with a base station of the second subsystem (WIO, BTS).

17. A network element according to claim 14 characterised by means (116) for routing a call between subscribers of the first group within the second subsystem (WIO, BTS), as a response to each of the numbers identifying said mobile subscribers in the communication system having a mapping to a network address of the second subsystem (WIO, BTS).

18. A method for communicating in a communication system, comprising a network switching system (MSC) and

a first subsystem (BSS) comprising one or more base stations (BTS) for communicating with mobile terminals (MS) via an air interface; and

a second subsystem (WIO, BTS) comprising one or more base stations (BTS) for communicating with the mobile terminals (MS) via an air interface, said

second base station subsystem (WIO, BTS) being accessible by a first group of mobile subscribers of the communication system, said method comprising;

transforming signals of the network switching system (MSC) and the base station (BTS) of said second subsystem into data packets of the second subsystem (WIO, BTS) and for transforming data packets of the second subsystem ((WIO, BTS) into signals of the network switching system (MSC) and the base station (BTS) of said second subsystem,

delivering data packets in the second subsystem (WIO, BTS) according to network addresses assigned to network elements of the second subsystem (WIO, BTS); and

mapping a number identifying a mobile subscriber in the communication system to a network address of the second subsystem (WIO) when the mobile terminal of the mobile subscriber is able to communicate with a base station of the second subsystem (WIO, BTS).

19. A method according to claim 18 further comprising routing a call between subscribers of the first group within the second subsystem (WIO, BTS), as a response to each of the numbers identifying said mobile subscribers in the communication system having a mapping to a network address of the second subsystem (WIO, BTS).

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

JOHANSSON, Folke
Nokia Corporation
P.O. Box 226
FIN-00045 Nokia Group
FINLANDE

23.0[illegible]00

X EYJ

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing *(day/month/year)*	23 06. 00
Applicant's or agent's file reference AK/14270 WO	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/FI99/00214	18/03/1999	18/03/1998

Applicant
NOKIA TELECOMMUNICATIONS OY et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Ghellere, M Tel.+49 89 2399-2053

Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
AK/14270 WO		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/FI99/00214	18/03/1999	18/03/1998
International Patent Classification (IPC) or national classification and IPC H04Q7/30		
Applicant NOKIA TELECOMMUNICATIONS OY et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of six sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
06/10/1999	23.06.00
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Rabe, M Telephone No. +49 89 2399 8801

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/FI99/00214

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-19	as published			

Claims, No.:

1-19	as received on	21/03/2000	with letter of	16/03/2000

Drawings, sheets:

1/9-9/9	as published

2. The amendments have resulted in the cancellation of:

☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-19
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-19
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-19
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Reference is made to the following document:

D1 = WO 95/33348

A. Citations and explanations made in respect of paragraph V:

1. The present invention relates to a **communication system**, to a corresponding **network element** in a communication system, and to a corresponding **method** for communicating in a communication system according to the features of respective independent **claims 1, 9, 14 and 18**.

2. **Generally**, in the past, separate networks have been deployed to handle traditional voice, data and video traffic, each with different transport requirements and each needing a separate terminal. In order to overcome the disadvantages of high costs and complexity thereof, efforts have been made to integrate different networks. In this respect, dual-mode phones have been suggested which access a local private network (eg. DECT) while in the office and a public network (eg. GSM) when outside of the office; the numbers can be mapped so that a subscriber can be reached using a single number.

   Document **D1** discloses a **communication system** comprising a mobile switching system, a **first subsystem** comprising one or more base stations for communicating with mobile terminals via an air interface, and a **second subsystem** comprising one or more base stations for communicating with the mobile terminals via an air interface and being accessible by a first group of mobile subscribers of the communication system, and comprising an **interworking function** for interconnecting the first and second subsystems, and **means for mapping** a number identifying a mobile subscriber in the communication system to a network address of the second subsystem when the mobile terminal of the mobile subscriber is able to communicate with a base station of the second subsystem.

3. A main **disadvantage** related to the system of document **D1** is that a particular interworking function (for transforming signals from one system (DECT) into signals of another system (GSM) and vice versa) must be provided between the first

and second subsystems to enable calls between separate base stations of the different subsystems, this increasing costs (eg. for intercompany calls) and complexity of the system.

4. The **present invention** overcomes these disadvantages by providing a **communication system**, a corresponding **network element** in a communication system, and a corresponding **method** for communicating in a communication system according to the features of respective independent **claims 1, 9, 14 and 18.**

According to the **essential features of the invention**, the communication system of the above known type further comprises one or more **first network elements** for **transforming** signals from the network switching system into **data packets** of the second subsystem and for **transforming data packets** from the second subsystem into signals of the network switching system, one or more **second network elements**, connected with one or more base stations of the second subsystem, for **transforming** signals from the base station of the second subsystem into **data packets** of the second subsystem and for **transforming data packets** from the second subsystem into signals to the base station of the second subsystem, and **means for delivering** data packets in the second subsystem according to a network address assigned to the first and the second network elements of the second subsystem.

According to **particular embodiments** of the present invention, the **network element** in the communication system of the present invention either comprises a **number of interfaces** to collect and store permanent and variable subscriber information of a subscriber of the first group from the mobile switching system and the second subsystem (claim 9), **or** it comprises **means for querying** from another network element the network address of the network element of the second subsystem connected to the base station the mobile terminal is currently able to communicate with (claim 14).

5. By including the first and second network elements in the communication system, signals from the MSC are transformed into data packets (and vice versa) which are sent over the delivering means (such as IP-based network or LAN) to another MSC or base station, thereby providing the **advantage** of reducing costs in inter-

company calls and more efficient use of the communication system.

6. The subject-matter of the present invention as claimed in respective independent claims 1, 9, 14 and 18 is neither disclosed in, nor rendered obvious by the remaining **prior art document** (ie. GB-A-2 269 723) cited in the international search report since said document, which merely relates to a very general state of the art of mobile radiotelephony and corresponding routing of calls between DECT- and GSM-based systems, does **not** describe the communication system, network elements or method according to the particular feature combination of the present invention or part thereof as defined in said respective independent claims 1, 9, 14 and 18.

7. The subject-matter of respective independent claims 1, 9, 14 and 18 therefore is considered to be **new** and to **involve an inventive step**, Article 33 (2) and (3) PCT.

8. As **claims 2 to 8, 10 to 13, 15 to 17 and 19** are dependent on respective claims 1, 9, 14 and 18, said claims 2 to 8, 10 to 13, 15 to 17 and 19 do **also meet** the requirements of Article 33 (2) and (3) PCT.

9. The present invention is **susceptible of industrial application**, Article 33 (4) PCT.

B. Remarks made in respect of paragraph VII:

1. To meet the requirements of Rule 5.1 (a) (ii) PCT, the cited document **D1** which represents a relevant prior art in respect of the present application, should have been identified in the opening part of the description and the relevant background art disclosed therein should have been briefly discussed.

2. To meet the requirements of Rule 6.3 (b) PCT, any independent claim should have been correctly cast in the **two-part form**, with those features which in combination are part of the nearest prior art (ie. document D1) being placed in

the preamble.

3. The opening part of the description should have been brought into conformity with the wording of the amended independent claims 1, 9, 14 and 18, Rule 5.1 (a) (iii) PCT.

C. Remarks made in respect of paragraph VIII:

The following amendment would have been necessary to the **claims**:

The various definitions of the network element given in independent claims 9 and 14 are such that the claims as a whole are **not concise**, contrary to Article 6 PCT. Moreover, **lack of clarity** of the claims as a whole arises, since the plurality of independent claims in the method category makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection.

The claims therefore should be recast to include only the **minimum necessary number of independent claims** in any one category, with dependent claims as appropriate (Rule 6.4 (a)-(c) PCT).

In the present case it is considered appropriate to use **only one** independent claim relating to the network element.

Claims

1. A communication system, comprising a mobile switching system (MSC) and

a first subsystem (BSS) comprising one or more base stations (BTS) for communicating with mobile terminals (MS) via an air interface; and

a second subsystem (WIO, BTS) comprising one or more base stations (BTS) for communicating with the mobile terminals (MS) via an air interface, said second subsystem (WIO, BTS) being accessible by a first group of mobile subscribers of the communication system, and comprising;

one or more first network elements (AGW; IGW) for transforming signals from the mobile switching system (MSC) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals of the mobile switching system (MSC),

one or more second network elements (IMC), connected with one or more base stations (BTS) of the second subsystem (WIO, BTS), for transforming signals from the base station (BTS) of the second subsystem (WIO, BTS) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals to the base station (BTS) of the second subsystem (WIO, BTS);

means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) according to a network address assigned to the first and the second network elements of the second subsystem (WIO, BTS); and

means (ILR, GK) for mapping a number identifying a mobile subscriber in the communication system to a network address of the second subsystem (WIO, BTS) when the mobile terminal of the mobile subscriber is able to communicate with a base station (BTS) of the second subsystem (WIO, BTS).

2. A communication system according to claim 1 wherein said second subsystem (WIO, BTS) comprises means (GK, ILR) for routing a call between subscribers of the first group within the second subsystem (WIO, BTS), as a response to each of the numbers identifying said mobile subscribers in the communication

system having a mapping to a network address of the second subsystem (WIO, BTS).

3. A communication system according to claim 1 wherein said second subsystem (WIO, BTS) comprises a subscriber register (ILR) for storing location information of a subscriber of the first group, said location information comprising data about the network address of the network element connected to the base station the mobile terminal of the subscriber is currently able to communicate with.

4. A communication system according to claim 1 wherein said means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) comprise an IP Protocol network.

5. A communication system according to claim 4 characterised by the first group of mobile subscribers comprising employees of an office given an access to said IP Protocol network.

6. A communication system according to claim 1 wherein said means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) support H.323 standard.

7. A communication system according to claim 2 wherein said means (GK, ILR) for routing a call between subscribers of the first group within the second subsystem (WIO, BTS) are arranged to page locally calls originating from or terminating to a terminal of a subscriber of the first group.

8. A communication system according to claim 2 wherein said means (GK, ILR) for routing are arranged to route the call to the mobile switching system (MSC), as a response to not fulfilling either of the following conditions: each of the subscribers belong to the first group, a number identifying each of said

subscribers in the communication system have a mapping to a network address of the second subsystem (WIO, BTS).

9. A network element (ILR) in a communication system, comprising a mobile switching system (MSC) and

a first subsystem (BSS) comprising one or more base stations (BTS) for communicating with mobile terminals (MS) via an air interface; and

a second subsystem (WIO, BTS) comprising one or more base stations (BTS) for communicating with the mobile terminals (MS) via an air interface, said second base station subsystem (WIO, BTS) being accessible by a first group of mobile subscribers of the communication system, and comprising;

one or more first network elements (AGW; IGW) for transforming signals from the mobile switching system (MSC) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals of the mobile switching system (MSC),

one or more second network elements (IMC), connected with one or more base stations (BTS) of the second subsystem (WIO, BTS), for transforming signals from the base station (BTS) of the second subsystem (WIO, BTS) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals to the base station (BTS) of the second subsystem (WIO, BTS);

means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) according to a network address assigned to the first and the second network elements of the second subsystem (WIO, BTS); and

said network element (ILR) comprising a number of interfaces to collect and store permanent and variable subscriber information of a subscriber of the first group from the mobile switching system (MSC) and the second subsystem (WIO, BTS).

10. A network element (ILR) according to claim 9 wherein said variable information comprises the network address of the network element (IMC) of the

second subsystem (WIO, BTS) connected to the base station (BTS) the mobile terminal (MS) the subscriber is currently able to communicate with.

11. A network element (ILR) according to claim 10 wherein the element (ILR) is arranged to collect and store the subscriber information at least during signalling between the base station (BTS) and the mobile terminal (MS) for location update of said subscriber to the second subsystem (WIO, BTS).

12. A network element (ILR) according to claim 9 arranged to send, as a response to a query from another network element (GK), said subscriber information.

13. A network element (ILR) according to claim 9 said interfaces comprising a MAP interface between the network element and at least one of the following: Home Location Register (HLR) of a GSM network, Visitor Location Register (VLR) of a GSM network.

14. A network element (GK) in a communication system, comprising a mobile switching system (MSC) and

a first subsystem (BSS) comprising one or more base stations (BTS) for communicating with mobile terminals (MS) via an air interface; and

a second subsystem (WIO, BTS) comprising one or more base stations (BTS) for communicating with the mobile terminals (MS) via an air interface, said second base station subsystem (WIO, BTS) being accessible by a first group of mobile subscribers of the communication system, and comprising;

one or more first network elements (AGW; IGW) for transforming signals from the mobile switching system (MSC) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals of the mobile switching system (MSC),

one or more second network elements (IMC), connected with one or more base stations (BTS) of the second subsystem (WIO, BTS), for transforming signals from the base station (BTS) of the second subsystem (WIO, BTS) into data packets of the second subsystem (WIO, BTS) and for transforming

data packets from the second subsystem (WIO, BTS) into signals to the base station (BTS) of the second subsystem (WIO, BTS);

means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) according to a network address assigned to network elements of the second subsystem (WIO, BTS); and

said element comprising means for querying from another network element (ILR) the network address of the network element (IMC) of the second subsystem (WIO) connected to the base station (BTS) the mobile terminal (MS) the subscriber is currently able to communicate with.

15. A network element according to claim 14 wherein the network element is arranged to implement functions of a H.323 Gatekeeper.

16. A network element (GK) according to claim 14 characterised by means (116) for mapping a number identifying a mobile subscriber in the communication system to a network address of the second subsystem (WIO) when the mobile terminal of the mobile subscriber is able to communicate with a base station of the second subsystem (WIO, BTS).

17. A network element according to claim 14 characterised by means (116) for routing a call between subscribers of the first group within the second subsystem (WIO, BTS), as a response to each of the numbers identifying said mobile subscribers in the communication system having a mapping to a network address of the second subsystem (WIO, BTS).

18. A method for communicating in a communication system, comprising a mobile switching system (MSC) and

a first subsystem (BSS) comprising one or more base stations (BTS) for communicating with mobile terminals (MS) via an air interface; and

a second subsystem (WIO, BTS) comprising one or more base stations (BTS) for communicating with the mobile terminals (MS) via an air interface, said

second base station subsystem (WIO, BTS) being accessible by a first group of mobile subscribers of the communication system, said method comprising;

transforming signals of the mobile switching system (MSC) and the base station (BTS) of said second subsystem into data packets of the second subsystem (WIO, BTS) and for transforming data packets of the second subsystem ((WIO, BTS) into signals of the mobile switching system (MSC) and the base station (BTS) of said second subsystem,

delivering data packets in the second subsystem (WIO, BTS) according to network addresses assigned to network elements of the second subsystem (WIO, BTS); and

mapping a number identifying a mobile subscriber in the communication system to a network address of the second subsystem (WIO) when the mobile terminal of the mobile subscriber is able to communicate with a base station of the second subsystem (WIO, BTS).

19. A method according to claim 18 further comprising routing a call between subscribers of the first group within the second subsystem (WIO, BTS), as a response to each of the numbers identifying said mobile subscribers in the communication system having a mapping to a network address of the second subsystem (WIO, BTS).

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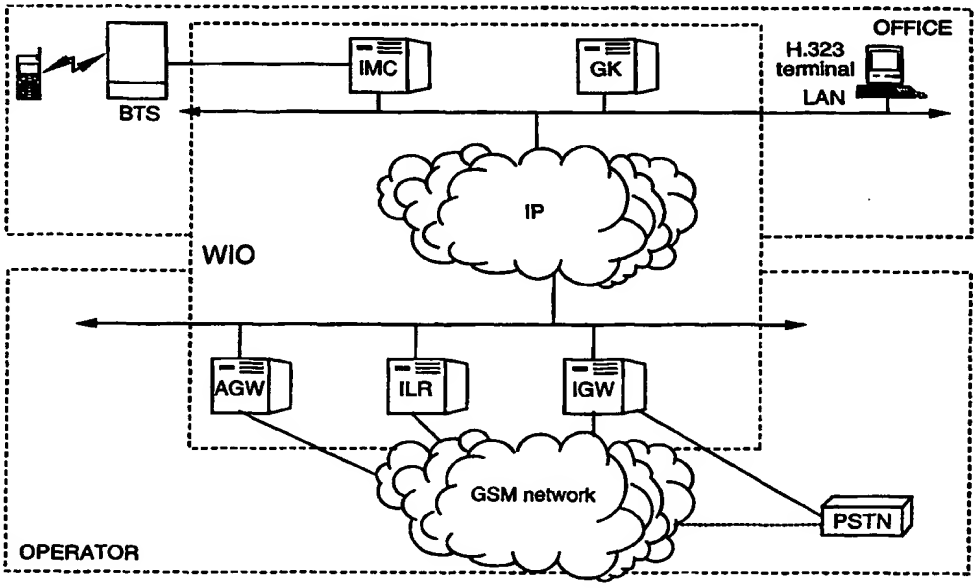

(57) Abstract

A communication system, comprising a network switching system (MSC) and in addition to a conventional subsystem (BSS) comprises a second subsystem (WIO, BTS) accessible by a first group of mobile subscribers of the communication system. Said second subsystem comprises means (ILR, GK) for mapping a number identifying a mobile subscriber in the communication system to a network address of the second subsystem (WIO, BTS) when the mobile terminal of the mobile subscriber is able to communicate with a base station (BTS) of the second subsystem (WIO, BTS).

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A METHOD AND SYSTEM FOR ROUTING A CALL BETWEEN CELLULAR SUBSYSTEMS

The present invention relates to a method and a system for telecommunication and more particularly to the integrated use of public and private communication networks.

Telecommunications have undergone a rapid change since the first digital cellular phones entered the market. Digital mobile technologies like GSM can now offer equivalent, if not better voice quality than the normal fixed line telephone. This, in addition to the obvious advantage of mobility, has been a reason for the increasing use of cellular telephones. In many cases cellular phones have become the phones of choice over the fixed line, even inside offices. A mobile communication connection, anyhow, is typically more expensive than a fixed connection. Thus the opportunity to use wireless connections outside the office tends to increase the general cost of calls for a company, as subscribers typically use the communication method that provides the best availability.

Another notable trend has been the introduction of many new products for IP Telephony systems. IP Telephony is an emerging set of technologies that enables voice, data and video collaboration over existing IP-based Local Area Networks (LAN), Wide Area Networks (WAN), and the Internet. IP Telephony has many advantages and one of them is its use as a cost-efficient way of implementing conventional telephony services, e.g. making long distance calls.

In the past, organisations have deployed separate networks to handle traditional voice, data and video traffic. Each with different transport requirements, these networks are expensive to install, maintain and reconfigure. Typically, also a separate terminal for each network is needed, which increases the costs and complicates things from the user's point of view. Furthermore, since these networks are physically distinct, their integration is very difficult, thus limiting their potential usefulness.

In Private Branch Exchanges (PBX) a conventional way of saving expenses in internal calls, fixed and mobile, is routing by internal short-dialling numbers. Such a method, anyhow, requires number information, which is typically not at hand when needed. A user relying on his personal telephone directory stored in the memory of his mobile terminal is often reluctant to maintain and use several numbers for one person, and the mobile subscriber number is often used, thus routing the call outside the office infrastructure. In this text and all of the following text "office" stands for an environment with several users, which users have a connection to a business entity, e.g. a company, and are permanently or temporarily authorised to access communication services provided by that entity.

Dual-mode phones accessing a local private network (e.g. DECT) while in the office and a public network (e.g. GSM) outside of the office are also suggested. In such a system the numbers can be mapped so that a subscriber can be reached using a single number. Such a solution, anyhow, requires the building and maintaining of overlapping communication networks in the office and still the services, e.g. Internet access away from one's desk is limited to a relatively narrow range of applications.

A recent means of connecting switches to computer systems is to use Computer Telephony Integration (CTI) gateways. CTI is most frequently used in environments where repositories of information, such as databases, must be accessed with each incoming call. This enables the person responding to the incoming telephone call to receive additional information about the client, e.g. previous buying history, preferences, geographical location, etc. However, the use of such CTI applications requires that switches are accessed through the open application programming interfaces provided by the gateways. Furthermore, in present CTI systems, voice and data are not actually consolidated but operate parallel to each other.

Now a communication system has been invented, wherein these problems and restrictions are overcome or their effects are remarkably reduced. In the invented

solution, new network elements are introduced to link the office network with the public mobile network so that when the user is in the office premises, the calls are routed to him through the office communication network, and when the user is outside the office, the calls are routed to him through the public mobile network. The interface to the mobile terminal remains the same disregarding the routing so that a conventional mobile terminal can be used in the office and outside it. When the user is in the office, the mobile subscriber number of the mobile network is mapped to the relevant network address thus enabling the use of only one subscriber number for addressing one subscriber. Intra-office calls, i.e. calls between parties with access to office network, are routed through the office network thus keeping the traffic and accordingly generating costs only within the office infrastructure.

According to a first aspect of the present invention there is provided a communication system, comprising a network switching system and a first subsystem comprising one or more base stations for communicating with mobile terminals via an air interface; and a second subsystem comprising one or more base stations for communicating with the mobile terminals via an air interface. The second subsystem is accessible by a first group of mobile subscribers of the communication system, and comprises one or more network elements for transforming signals from the network switching system into data packets of the second subsystem and for transforming data packets from the second subsystem into signals of the network switching system, one or more network elements connected with one or more base stations of the second subsystem for transforming signals of the network switching system from the base station into data packets of the second subsystem and for transforming data packets from the second subsystem into signals of the network switching system for the base station. Said second subsystem further comprises means for delivering data packets in the second subsystem according to a network address assigned to network elements of the second subsystem; and means for mapping a number identifying a mobile subscriber in the communication system to a network address

of the second subsystem when the mobile terminal of the mobile subscriber is able to communicate with a base station of the second subsystem.

Further aspects of the invention are presented by the network elements as claimed in the independent claims 9 and 14, and by a method as claimed in the independent claim 16. Preferred embodiments of the invention are presented with dependent claims.

From the user perspective, the benefit of the invention derives from the fact that the functions required for optimising the routing are transparent to him. Mobility in the office and outside it is extensively supported, but the task of considering the costs arising from the use of different networks no longer concerns the employee. One number can be used for one subscriber without considering whether the call is within the office or not. Furthermore, computer telephony integration enables a broad spectrum of enhanced services.

From the company perspective, further benefit of the invention derives from the fact that the quality and the quantity of services can be increased without increasing the costs. In many cases costs can even be decreased. Through computer telephony integration an increased manageability and adaptability of services is reached leading to a better service to the customer, which increases productivity in general.

Office network is preferably an IP (Internet Protocol) based network, which may be a simple LAN or a complex interconnected corporate WAN. Public mobile network is preferably a digital Public Land Mobile Network (PLMN) provided and maintained by the operator and providing cellular coverage to a mobile terminal in a considerably larger area than the office premises. Though systems supporting any standard or any multiple access schemes (Time Division Multiple Access, Code Division Multiple Access) can be used, due to its extensive global coverage GSM system is used here as a preferred embodiment.

For a better understanding of the present invention and in order to show how the same may be carried into effect reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 illustrates the basic concept of invented system;

Figure 2 illustrates handling different type of services through one network;

Figure 3 illustrates the scope of H.323 specification;

Figure 4 illustrates different core functions of the invented solution and the way they are arranged in relation to the access functions;

Figure 5 illustrates the architecture of the invented system;

Figure 6 illustrates the implementation of the storage and retrieval functions concerning mobile subscriber information managed by the Intranet Location Register;

Figure 7 illustrates a functional architecture of the A-Gateway Element;

Figure 8 illustrates the architecture of the ISDN/IP Gateway;

Figure 9 illustrates the functional architecture of the Intranet Mobile Cluster

Figure 10 illustrates functional units and interfaces of the WIO Gatekeeper;

Figure 11 illustrates functional elements of the Intranet Mobile Cluster;

Figure 12 illustrates interfaces of the presented embodiment;

Figure 13 illustrates the method of routing calls in the invented system;

The block diagram in Figure 1 illustrates the basic concept of invented system using GSM as the public mobile network. In a conventional GSM system mobile stations MS are in connection with base stations BTS using radio communication. The base stations BTS are further, through a so-called Abis interface, connected to a base station controller BSC, which controls and manages several base stations. The entity formed by several base stations BTS and a single base station controller BSC controlling them are called a base station subsystem BSS. Particularly, the base station controller BSC manages radio-communication channels, as well as handovers. On the other hand, the base station controller BSC is, through the so-called A interface, in connection with a mobile services switching centre (MSC), which co-ordinates the establishment of connections to and from mobile stations. Through the mobile services switching centre MSC, a

connection can further be established to a subscriber not operating under the mobile communication network.

In the invented system a base station BTS in the office WIO (Wireless Internet Office) premises is functionally connected to a office network LAN, which is connected through a IP network to the MSC. When the MS is within the coverage of the base station BTS mobile terminating and mobile originating calls, as well as other services e.g. GSM data, fax and short messages will be handled via office network LAN. When the MS is not within the coverage of a base station BTS, services will be handled in a conventional way via BSS.

It should be noted that Figure 1 is a simplified illustration of the solution. There can be more than one MSCs and they can be connected to several other communication networks, e.g. PLMN, PSTN and ISDN. The LAN can be connected to an other LAN of the same business entity in another location and they can be connected by IP/Intranet.

Traditionally, different types of media, i.e. voice, data and video have been delivered separately. The recent development of IP Telephony is focusing of handling different type of services through one network, as shown in Figure 2. IP Telephony blends voice, video and data by specifying a common transport medium, IP, for each. Specifically, IP Telephony uses open IETF (Internet Engineering Task Force) and ITU (International Telecommunication Union) standards to move multimedia traffic over any network that uses IP thus offering users both flexibility in physical media (for example, plain old telephone service lines, ADSL, ISDN, leased lines, coaxial cable satellite and twisted pair) and flexibility in physical location. As a result, the same ubiquitous networks that carry Web, e-mail and data traffic can be used to connect to individuals, businesses, schools and governments world-wide.

As a preferred embodiment for office network protocol ITU standard H.323 is used. H.323 is an open standard for multimedia communications (voice, video and

data) over connectionless networks, often thought of as the "Internet" videoconferencing standard, but actually designed to support any combination of audio, video and data and be implemented on any LAN protocol (IPX, TCP/IP). The block chart of Figure 3 illustrates the scope of H.323 specification (dotted line). H.323 provides for call control, multimedia management and bandwidth management for point-to point and multipoint conferences. H.323 mandates support for standard audio and video codecs and supports data sharing via the T.120 standard. H.323 is also network, platform and application independent, allowing any H.323 compliant terminal to inter-operate with any other terminal.

H.323 allows multimedia streaming over current packet switched networks. To counter the effects of LAN latency, H.323 uses Real-time Transport Protocol (RTP), which is an IETF standard designed to handle the requirements of streaming real-time audio and video over the Internet. Overhead per packet in H.323 are 12 bytes for RTP header, 8 bytes for UDP, 20 bytes for IP and about 1-3 bytes for link-level header and framing. Any H.323 client is guaranteed to support the standards H.261 and G.711. H.261 is an ITU standard for video codec design to transmit compressed video at a rate of 64 kbps and at a resolution of 176x44 pixels (QCIF). G.711 is an ITU standard for audio codec designed to transmit A-law and μ-law PCM audio bit rates of 48, 56, and 64 kbps. Optionally H.323 client may support additional codecs like H.263 and G.723. H263 is an ITU standard video codec and G.723 is an ITU standard audio codec designed to operate at very low bit-rates.

For system control H.323 standard specifies three command and control protocols, wherein H.245 is responsible for control messages governing operation of the H.323 terminal, including capability exchanges, commands and indications. H.225.0 (Q.931) is used to set up a connection between two terminals and RAS governs registration, admission and bandwidth functions between endpoints and gatekeepers.

For a H.323 based communication system the standard defines four major components. *Terminals* are the client endpoints on the network. All terminals must support voice communications; video and data support is optional.

Gateways bridge H.323 conferences to other networks or communication protocols. Gateways are not required if connections to other networks, or non-H.323 compliant terminals, are not needed.

Gatekeepers perform two important functions: address translation, and bandwidth management. These functions help the gatekeeper to maintain the healthy state of the network. The Gatekeeper also exercises call control functions to limit the number of H.323 connections, and the total bandwidth used by these connections, in a H.323 "zone." One H.323 zone is a collection of all terminals, gateways and multipoint control units (MCU) managed by a single gatekeeper. A Gatekeeper is not required in a H.323 system. However, if a Gatekeeper is present, terminals must make use of its services.

Multipoint Control Units support conferences between three or more endpoints. An MCU consists of a required Multipoint Controller (MC) and zero or more Multipoint Processors (MPs). The MC performs H.245 negotiations between all terminals to determine common audio and video processing capabilities, while the MP routes audio, video, and data streams between terminal endpoints. An MCU is also optional.

The invented system is based on utilising the recent development in integrated communication systems for combining public mobile network with private networks in a way that is advantageous for different parties in the processes. Furthermore, for implementing said invented system new elements have been invented.

In Figure 4 a description of different core functions of the invented solution and the way they are arranged in relation to the access functions is presented. From the corporate perspective the invented system enables company wide

telecommunication services provided internally using data communication resources. For public access, co-operation with the local telecommunications operator is necessary. From the operator perspective, users of the invented system may share the resources of a public TCP/IP interconnection service, telecommunication networks and end user service access points, but use private LANs to access the public network side and other users within the company WAN. Appreciating the fact that PBX industry working on CTI is moving the development of end-user services and applications to computer environment, the potential synergy in developing value added services and multimedia services is apparent. The core functions of the invented system include directory services, call control service, mobility management, operation and maintenance, billing, quality of service guarantee and security services. Figuratively speaking the invented system can be seen as a new kind of GSM BSS/NSS with a specific location register or as an extension to the packet based multimedia communication system specified in the H.323 Recommendation.

In Figure 5, the architecture of the invented system is illustrated. As can be seen, all new network elements are located between A-interface and Abis-interface. In the following, the term WIO (Wireless Internet Office) is used for the entity that comprises the new functions and new elements in the invented system, anyhow not limiting the scope of protection to any of the names of the products associated with the invented system. WIO has at least three different gateways AGW, IGW, IMC each having different interfaces to separate parts of the GSM or the H.323 network. It should be noted that the gateway function according to H.323 is only one of the functions these components take care of.

In the operator side the WIO block comprises network elements AGW, IGW and ILR, the purpose and functions of which are now explained in more detail.

The purpose of A-interface gateway AGW is to handle communication between the office network and the public mobile network through MSC. AGW provides both signalling and traffic routing between the office network and MSC, and

thereby forms a BSS interface to the MSC. From the MSC point of view WIO thus looks like one or more BSSs with a certain Location Area Code (LAC). AGW can be connected to the MSC directly with A-interface. Anyhow, AGW does not necessarily need to provide transcoding functions, and therefore it can alternatively be connected using a Ater-interface to a transcoder (e.g. Nokia Transcoder TCSM2) typically arranged between the MSC and BSC. The transcoding function is thereby not performed in the AGW unit itself, but the function of the AGW is to convert PCM based traffic into IP and vice versa.

In Figure 7 a functional architecture of the AGW is illustrated. As the signalling between the AGW and the MSC follows the standard signalling and interfaces, there are no restrictions regarding the use of the MSC. AGW is preferably implemented with a computer, e.g. NT server. The performance of AGW depends both on the server configuration as well as the used LAN (IP stack throughput, Ethernet, etc.). However, one logical AGW can be realised as a cluster of servers. Depending on the configuration the number of supported voice traffic channels varies. For example, to support one multiplexed E1 connection, a configuration of two servers is needed, thus creating around 120 traffic channels.

The functions of the AGW comprise at least most of the following:

- signalling conversion and termination: A-interface – WIO
- traffic routing: Ater interface – WIO
- Ater / A-interface channel management
- TRAU (Transcoding and Rate Adaption Unit) frame handling
- IP DTX (discontinuous speech over IP)
- transcoder (TCSM2E) control
- support for WIO Operation and Management (O&M)
- creating traffic and load statistics
- pool option (possibility to cluster servers together).

The signalling between all the WIO components is preferentially encrypted, and this relates to also to communication between the unit implementing O&M and

AGW. AGW typically collects statistical information of its central transactions and especially of detected failures and disturbances. WIO Gatekeeper elements (presented later) constantly control status of other WIO network elements, and hence AGW provides responses to those enquiries as well. Ongoing WIO calls are disconnected by MSC. In case WIO network connection breakdown, AGW closes temporarily also the MSC signalling link.

The second element in the operator side is the ISDN/IP Gateway (IGW) that manages communication between WIO and the public telephone network, and it is a gateway that is typically defined in the CTI concept. Preferably Digital Signalling System No. 1 (DSS.1) is used. In Figure 8 a functional architecture of the IGW is illustrated. IGW has an interface to both MSC and PSTN. From MSC point of view IGW looks like a PBX. IGW supports transcoding between ITU-T standards G.711 and G.723 as well as G.711 and GSM 06.10. IGW collects statistical information of its central transactions and especially of detected failures and disturbances, and forwards the information to O&M application through WIO Gatekeeper (explained later). The architecture of IGW is based on a similar hardware as the AGW.

The third element shown in the operator side is Intranet Location Register ILR that takes care of the directory services in WIO. GSM provides a Home Location Register (HLR), which is a register where all subscriber parameters of a mobile subscriber are permanently stored, and one or more Visitor Location Registers (VLR) where all subscriber parameters for call set-up are temporarily stored as long as a subscriber is in a location area controlled by the register. Being part of the state of the art these registers are generally known to a person skilled in the art.

The Intranet Location Register (ILR) is a database taking care of the permanent subscriber data storage in WIO, while on the other hand it is an access manager to subscriber data in the HLR and the billing system. The purpose of the ILR is to provide a storage base for retrieving Mobile Station (MS) specific information

configured for the WIO system. All the MS's configured to WIO have a permanent entry in the database. These MS specific settings are valid when the MS is logged into the WIO system.

Furthermore, the WIO Gatekeeper (explained later in more detail) in the office side updates the mapping of current address of each MS within the WIO region, in the directory. The ILR is connected to the HLR and VLR through the MAP interface. The main task for the ILR towards the HLR, is to retrieve a subscriber's service profile information from the HLR, such as supplementary service settings, etc. The ILR runs e.g. on a Windows NT server based on industry standard Pentium technology. In order to fulfil its tasks well, the server shall provide high-availability, fault-tolerance and fast recovery.

In Figure 6 a more detailed illustration of the implementation of the storage and retrieval functions concerning mobile subscriber information managed by the ILR is presented. It should be noted that the shown interfaces apply to the present embodiment and do not exclude equivalent implementations comprising more or less interfaces. The *ILR Interface* implements storage and retrieval functions concerning mobile subscriber information managed by the ILR. The function makes database related details transparent the WIO Gatekeeper, so that a change in the underlying storage method does not require any changes in the WIO Gatekeeper. The ILR provides the coding and decoding of requests asked for by the WIO Gatekeeper, and also returns information requested by the WIO Gatekeeper.

The HLR Interface is used to retrieve a mobile subscriber's basic information as well as their supplementary service settings from the HLR. MS Gatekeeper location address is stored in the ILR and also the retrieval is carried out in connection with Location Update. The mobile location update request from the WIO Gatekeeper acts as a triggering event for HLR information retrieval.

The VLR interface is used to request a subscriber's IMSI (International Mobile Subscriber Identity), if a mobile station identifies itself with the TMSI (Temporary Mobile Subscriber Identity) during the first location update to the WIO area. In both cases the MAP protocol is used.

The LDAP Interface provides means to retrieve and maintain MS specific information stored in Directory service database connected to the ILR. This information is gathered from different sources like HLR Interface and IN Interface. The protocol used in the communication with Directory service is Lightweight Directory Access Protocol (LDAP).

IN Interface is an optional interface that provides means for retrieving subscriber's additional service information from Intelligent Network e.g. private numbering enabling the use of short codes within WIO. This interface is based on e.g. Service Management Interface (SMI) provided by IN.

Billing Interface provides means for transferring billing related raw data into billing system to be post-processed. In this embodiment local database ILR acts as an intermediate storage for billing information collected by the WIO Gatekeeper.

In the office side of the WIO, the network elements Intranet Mobile Cluster IMC and WIO Gatekeeper GK are shown in Figure 5. As mentioned earlier, the Intranet Mobile Cluster (IMC) is substantially a gateway in H.323 terminology, and it is simulating the actions of the BSC in the WIO environment. The IMC uses LAPD based Q.931 and GSM specific signalling and generates TRAU frames for speech and data for an Abis interface. It also manages the radio resources and channel configurations, and handles configuration of the BTS. The IMC provides GSM signalling and stream conversions to other WIO components. It also detects the need for possible handover and power control actions during a call.

IMC core functionalities illustrated by the functional layers of Figure 9 towards WIO cover running CVOPS with GSM signalling protocols, running WIO system

control and IP ciphering, controlling the socket interface towards the WIO Gatekeeper and controlling the socket interface towards the GSM/IP traffic option on the LAPD server. The main functions of the IMC towards BTS are:

- BTS control and management
- radio resource control and management
- radio network control and management
- radio channel configuration and management
- IP DTX
- RF frequency hopping
- handover algorithm and target cell list reporting
- handover management
- speech conversion from IP traffic to G.703 and TRAU frame generation to the Abis side.
- IMC state management
- radio object state management
- IMC and radio access fault management
- status report generation.

The IMC is typically implemented as a radio-controlling unit, which is based e.g. on a Pentium®PC with an E1 interface card.

IMC comprises substantially three functional elements as illustrated in Figure 11. The Radio Access part 111 comprises a radio receiver 112 and transmitting unit 113, E1 interface 114. The Data Processing Unit 116 is typically implemented with a computer; e.g. a Pentium® based NT computer. The DPU 116 further comprises three functional elements: Radio Resource Handling Unit 117, Operation and Maintenance Unit 118 and Telecommunication Unit 119. WIO Interface Unit 120 is preferably a LAN interface card supporting a number of physical connections.

The second element shown in the office side in Figure 5 is the WIO Gatekeeper. Gatekeeper is typically an element for providing services such as call forwarding, automatic re-routing and detailed departmental billing in an IP network. WIO

Gatekeepers tasks in the WIO system comprise furthermore providing call control services to the WIO endpoints.

The tasks the Gatekeeper comprise at least most of the following:

- address translation functions
- bandwidth management
- call management
- mobility management
- giving paging requests to the IMCs (explained later)
- checking service profiles and authorisation of WIO services
- collecting call data records (CDR)
- forwarding call data records to the ILR
- offering an interface for the O&M application
- checking functionality of other WIO components
- taking care of terminal registration and status handling.

Some of these are well known to a person skilled in the art and some will be explained here in more detail. Gatekeeper comprises several functional units and interfaces that are illustrated in Figure 10.

Device Management 101 is responsible for status handling of other WIO entities as well as terminal registration. Device Manager stores WIO specific information to the Device Database 102.

Operation and maintenance 103 comprises an optional WIO Gatekeeper charging function, which collects information from calls, creates charging records (CDR) out of them and sends them to the ILR.

Call Management 104 can be defined as a set of functions that enable and control telecommunications between two or more parties. In the invented solution Call Management provides a scaleable basic infrastructure and creates an extensible platform for new advanced services. Call Management is needed to support

information such as mapping IP addresses and phone numbers to each other. The WIO Gatekeeper is arranged to manage different call types, such as voice, data, facsimile, SMS, and conference calls. These calls can be established between two of the following: a mobile station, a network terminal and a fixed telephone. The call between a fixed and a mobile phone is established through MSC as long as there is no gateway between the PBX and the WIO infrastructure.

Gatekeeper manages both internal and external calls. Internal calls are calls that are made either under the same WIO Gatekeeper, or between subscribers under two different WIO Gatekeepers of one office. External calls, are calls where either of the subscribers does not have access to the office network.

WIO Gatekeeper manages a location area. When a subscriber in the office is called from the external network, the call is routed by the IGW or the AGW to the WIO Gatekeeper under which the called mobile station is currently located. The location data is queried by the IGW or the AGW from the ILR. After this the WIO Gatekeeper sends a broadcast-paging message to each IMC within the zone it is managing and routes the call to the right one.

In another case both subscribers are in the area of the same Gatekeeper. Then the WIO Gatekeeper, detecting that the B-subscriber is under the same WIO Gatekeeper, sends a Paging broadcast message to each IMC under it. The IMC where the subscriber is registered to sends its answer to the WIO Gatekeeper, and the gatekeeper routes the call to this IMC.

In a situation where a subscriber in the office is calling a subscriber outside the office, the WIO Gatekeeper checks the location of subscriber B. If it does not find the subscriber B, WIO Gatekeeper routes the call to the MSC through the AGW.

Mobility management 105 includes tasks related to the mobility of the user, such as location updates and handovers. Location update is done each time a new subscriber having access to the office network arrives in the office environment.

Also other subscribers (e.g. visitors) are preferably allowed to make location updates in WIO, however, their calls are routed through the MSC. This function is preferably configured so that the operator can allow external subscribers to use base stations connected to WIO as well. Inside WIO the subscriber information is received from the ILR.

A handover request message is sent to the WIO Gatekeeper by the IMC. This message includes a list of the best target cells. Handovers that work in the normal GSM network also work in WIO. One exception, however, is a handover from WIO to an external non-WIO cell. This is not possible if the phone call is an internal, non-MSC controlled call. If the phone call is a MSC controlled call, it means that A-subscriber is inside the office, and B-subscriber is outside the office, and handover is, in this case, possible. The exception provides for the tariffing scheme, which can be different for intra-office calls (i.e., low tariff or even free of charge). It is advantageous to have means to control the implementation of this special tariffing whenever the calling or the called mobile station is moving outside office coverage.

The Gatekeeper preferably collects statistical information from all transactions made in WIO (i.e. voice and data call, facsimile, SMS, failed call, etc.). This information is stored to the file, then delivered to the ILR if the information is needed for billing purposes. The billing interface in the ILR collects information relating to 'call data records' (CDR), and sends it to the billing system.

It should be noted that the division of the functionalities between the IMC and the WIO Gatekeeper apply for the embodiment shown here. Equivalent applications can be implemented by changing or dividing the functionalities differently to either or both of the elements.

As shown earlier, interfaces related with WIO comprise substantially standard interfaces. In Figure 12, interfaces of the presented embodiment are illustrated. WIO has two interfaces towards MSC. One is realised with IGW and the other

one with AGW. IGW fulfils the DSS.1 standard requirements by providing layer 2 (LAPD) and layer 3 (Q.931) protocol services. The MSC interface is compliant with several standards, like E1, 2048Mbit/s (based on G.703 and G.704), LAPD (Q.921) and Layer 3 where standards Q.931 and Q.932 are used. IGW uses D"".1 standard also towards PBX and PSTN. Towards Mobile station, cellular standard e.g. GSM is used. The ILR implements MAP interface towards the HLR and VLR. WIO Gatekeeper uses H.323 protocol to communicate with other WIO entities in the following way:

- PC terminal and WIO entities are registered to the WIO Gatekeeper by RAS channel
- Q.931 channel is used during call establishment
- H.245 is used during calls for capacity, codec and multipoint call control
- WIO uses Routed Signalling Model based on the H.323 standard. All signalling between WIO Gatekeeper and other WIO elements are preferably encrypted.

The following interfaces are supported in WIO elements of this embodiment:

- LAN interface
- WinSock2
- RTP/RTCP to control voice packet transmission in UDP datagrams.

In Figure 13, the method of routing calls in the invented system are illustrated. As an example steps related to a Mobile Originating call from a WIO subscriber in the office environment is presented. In step 131 the IMC receives a call set-up request from the subscriber A comprising the number of the subscriber B. The request is delivered to the WIO Gatekeeper that will check from the ILR (step 132) whether the subscriber B is a WIO subscriber or not (step 133). If the subscriber B is a WIO subscriber, WIO Gatekeeper pages all IMCs it controls (step 134) and checks whether it receives an answer (step 135). If, for some reason, no answer is received, the call will be cancelled (step 136). If the IMC to which the BTS communicating with the MS of the subscriber A answers, a connection is established by the IMC elements of subscriber A and subscriber B (step 137). If the subscriber B is not a WIO subscriber, WIO Gatekeeper will route the call via

AGW (step 139) to the MSC, and the call set-up will be implemented in a conventional way (step 140), though the data transfer involves both GSM and H.323.

Although the invention has been shown and described in terms of a preferred embodiment, those persons of ordinary skill in the art will recognise modifications to the preferred embodiment may be made without departure from the scope of the invention as claimed below.

Claims

1. A communication system, comprising a network switching system (MSC) and

a first subsystem (BSS) comprising one or more base stations (BTS) for communicating with mobile terminals (MS) via an air interface; and

a second subsystem (WIO, BTS) comprising one or more base stations (BTS) for communicating with the mobile terminals (MS) via an air interface, said second subsystem (WIO, BTS) being accessible by a first group of mobile subscribers of the communication system, and comprising;

one or more first network elements (AGW; IGW) for transforming signals from the network switching system (MSC) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals of the network switching system (MSC),

one or more second network elements (IMC), connected with one or more base stations (BTS) of the second subsystem (WIO, BTS), for transforming signals from the base station (BTS) of the second subsystem (WIO, BTS) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals to the base station (BTS) of the second subsystem (WIO, BTS);

means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) according to a network address assigned to the first and the second network elements of the second subsystem (WIO, BTS); and

means (ILR, GK) for mapping a number identifying a mobile subscriber in the communication system to a network address of the second subsystem (WIO, BTS) when the mobile terminal of the mobile subscriber is able to communicate with a base station (BTS) of the second subsystem (WIO, BTS).

2. A communication system according to claim 1 wherein said second subsystem (WIO, BTS) comprises means (GK, ILR) for routing a call between subscribers of the first group within the second subsystem (WIO, BTS), as a response to each of the numbers identifying said mobile subscribers in the communication

system having a mapping to a network address of the second subsystem (WIO, BTS).

3. A communication system according to claim 1 wherein said second subsystem (WIO, BTS) comprises a subscriber register (ILR) for storing location information of a subscriber of the first group, said location information comprising data about the network address of the network element connected to the base station the mobile terminal of the subscriber is currently able to communicate with.

4. A communication system according to claim wherein said means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) comprise an IP Protocol network.

5. A communication system according to claim 4 characterised by the first group of mobile subscribers comprising employees of an office given an access to said IP Protocol network.

6. A communication system according to claim 1 wherein said means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) support H.323 standard.

7. A communication system according to claim 2 wherein said means (GK, ILR) for routing a call between subscribers of the first group within the second subsystem (WIO, BTS) are arranged to page locally calls originating from or terminating to a terminal of a subscriber of the first group.

8. A communication system according to claim 2 wherein said means (GK, ILR) for routing are arranged to route the call to the network switching system (MSC), as a response to not fulfilling either of the following conditions: each of the subscribers belong to the first group, a number identifying each of said

subscribers in the communication system have a mapping to a network address of the second subsystem (WIO, BTS).

9. A network element (ILR) in a communication system, comprising a network switching system (MSC) and

a first subsystem (BSS) comprising one or more base stations (BTS) for communicating with mobile terminals (MS) via an air interface; and

a second subsystem (WIO, BTS) comprising one or more base stations (BTS) for communicating with the mobile terminals (MS) via an air interface, said second base station subsystem (WIO, BTS) being accessible by a first group of mobile subscribers of the communication system, and comprising;

one or more first network elements (AGW; IGW) for transforming signals from the network switching system (MSC) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals of the network switching system (MSC),

one or more second network elements (IMC), connected with one or more base stations (BTS) of the second subsystem (WIO, BTS), for transforming signals from the base station (BTS) of the second subsystem (WIO, BTS) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals to the base station (BTS) of the second subsystem (WIO, BTS);

means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) according to a network address assigned to the first and the second network elements of the second subsystem (WIO, BTS); and

said network element (ILR) comprising a number of interfaces to collect and store permanent and variable subscriber information of a subscriber of the first group from the network switching system (MSC) and the second subsystem (WIO, BTS).

10. A network element (ILR) according to claim 9 wherein said variable information comprises the network address of the network element (IMC) of the

second subsystem (WIO, BTS) connected to the base station (BTS) the mobile terminal (MS) the subscriber is currently able to communicate with.

11. A network element (ILR) according to claim 10 wherein the element (ILR) is arranged to collect and store the subscriber information at least during signalling between the base station (BTS) and the mobile terminal (MS) for location update of said subscriber to the second subsystem (WIO, BTS).

12. A network element (ILR) according to claim 9 arranged to send, as a response to a query from another network element (GK), said subscriber information.

13. A network element (ILR) according to claim 9 said interfaces comprising a MAP interface between the network element and at least one of the following: Home Location Register (HLR) of a GSM network, Visitor Location Register (VLR) of a GSM network.

14. A network element (GK) in a communication system, comprising a network subsystem (MSC) and

a first subsystem (BSS) comprising one or more base stations (BTS) for communicating with mobile terminals (MS) via an air interface; and

a second subsystem (WIO, BTS) comprising one or more base stations (BTS) for communicating with the mobile terminals (MS) via an air interface, said second base station subsystem (WIO, BTS) being accessible by a first group of mobile subscribers of the communication system, and comprising;

one or more first network elements (AGW; IGW) for transforming signals from the network switching system (MSC) into data packets of the second subsystem (WIO, BTS) and for transforming data packets from the second subsystem (WIO, BTS) into signals of the network switching system (MSC),

one or more second network elements (IMC), connected with one or more base stations (BTS) of the second subsystem (WIO, BTS), for transforming signals from the base station (BTS) of the second subsystem (WIO, BTS) into data packets of the second subsystem (WIO, BTS) and for transforming

data packets from the second subsystem (WIO, BTS) into signals to the base station (BTS) of the second subsystem (WIO, BTS);

means (IP, LAN) for delivering data packets in the second subsystem (WIO, BTS) according to a network address assigned to network elements of the second subsystem (WIO, BTS); and

said element comprising means for querying from another network element (ILR) the network address of the network element (IMC) of the second subsystem (WIO) connected to the base station (BTS) the mobile terminal (MS) the subscriber is currently able to communicate with.

15. A network element according to claim 14 wherein the network element is arranged to implement functions of a H.323 Gatekeeper.

16. A network element (GK) according to claim 14 characterised by means (116) for mapping a number identifying a mobile subscriber in the communication system to a network address of the second subsystem (WIO) when the mobile terminal of the mobile subscriber is able to communicate with a base station of the second subsystem (WIO, BTS).

17. A network element according to claim 14 characterised by means (116) for routing a call between subscribers of the first group within the second subsystem (WIO, BTS), as a response to each of the numbers identifying said mobile subscribers in the communication system having a mapping to a network address of the second subsystem (WIO, BTS).

18. A method for communicating in a communication system, comprising a network switching system (MSC) and

a first subsystem (BSS) comprising one or more base stations (BTS) for communicating with mobile terminals (MS) via an air interface; and

a second subsystem (WIO, BTS) comprising one or more base stations (BTS) for communicating with the mobile terminals (MS) via an air interface, said

second base station subsystem (WIO, BTS) being accessible by a first group of mobile subscribers of the communication system, said method comprising;

transforming signals of the network switching system (MSC) and the base station (BTS) of said second subsystem into data packets of the second subsystem (WIO, BTS) and for transforming data packets of the second subsystem ((WIO, BTS) into signals of the network switching system (MSC) and the base station (BTS) of said second subsystem,

delivering data packets in the second subsystem (WIO, BTS) according to network addresses assigned to network elements of the second subsystem (WIO, BTS); and

mapping a number identifying a mobile subscriber in the communication system to a network address of the second subsystem (WIO) when the mobile terminal of the mobile subscriber is able to communicate with a base station of the second subsystem (WIO, BTS).

19. A method according to claim 18 further comprising routing a call between subscribers of the first group within the second subsystem (WIO, BTS), as a response to each of the numbers identifying said mobile subscribers in the communication system having a mapping to a network address of the second subsystem (WIO, BTS).

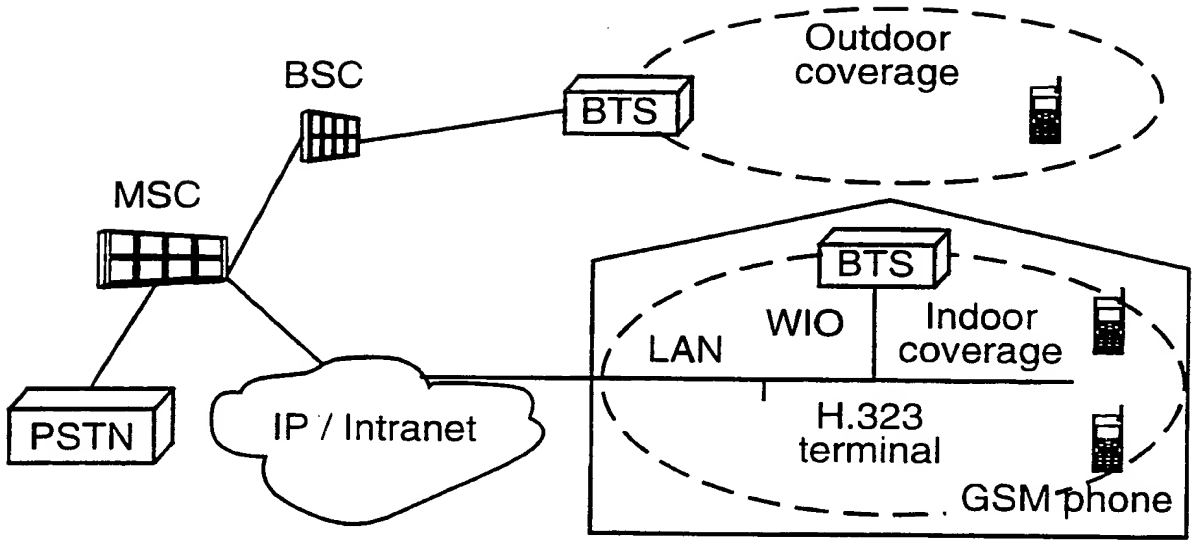

FIGURE 1

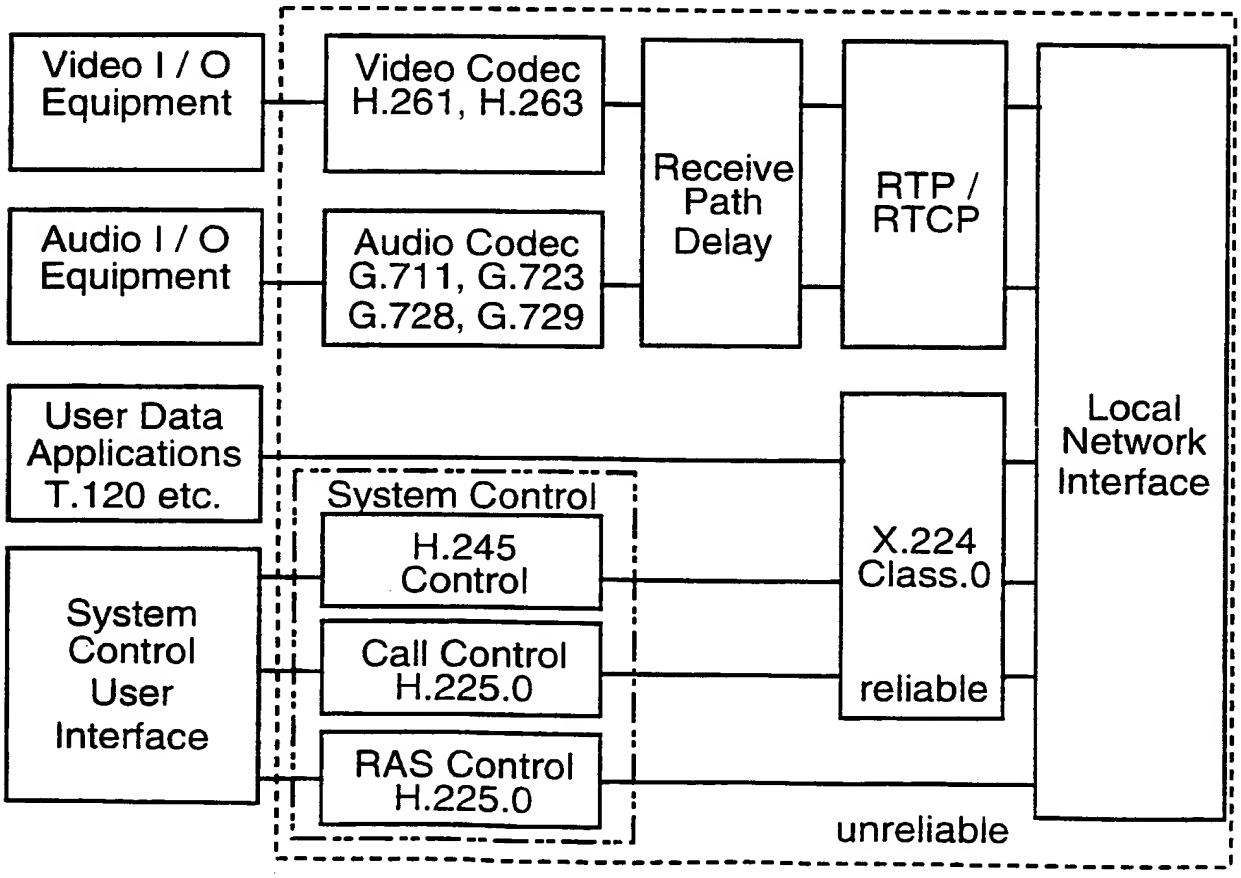

FIGURE 3

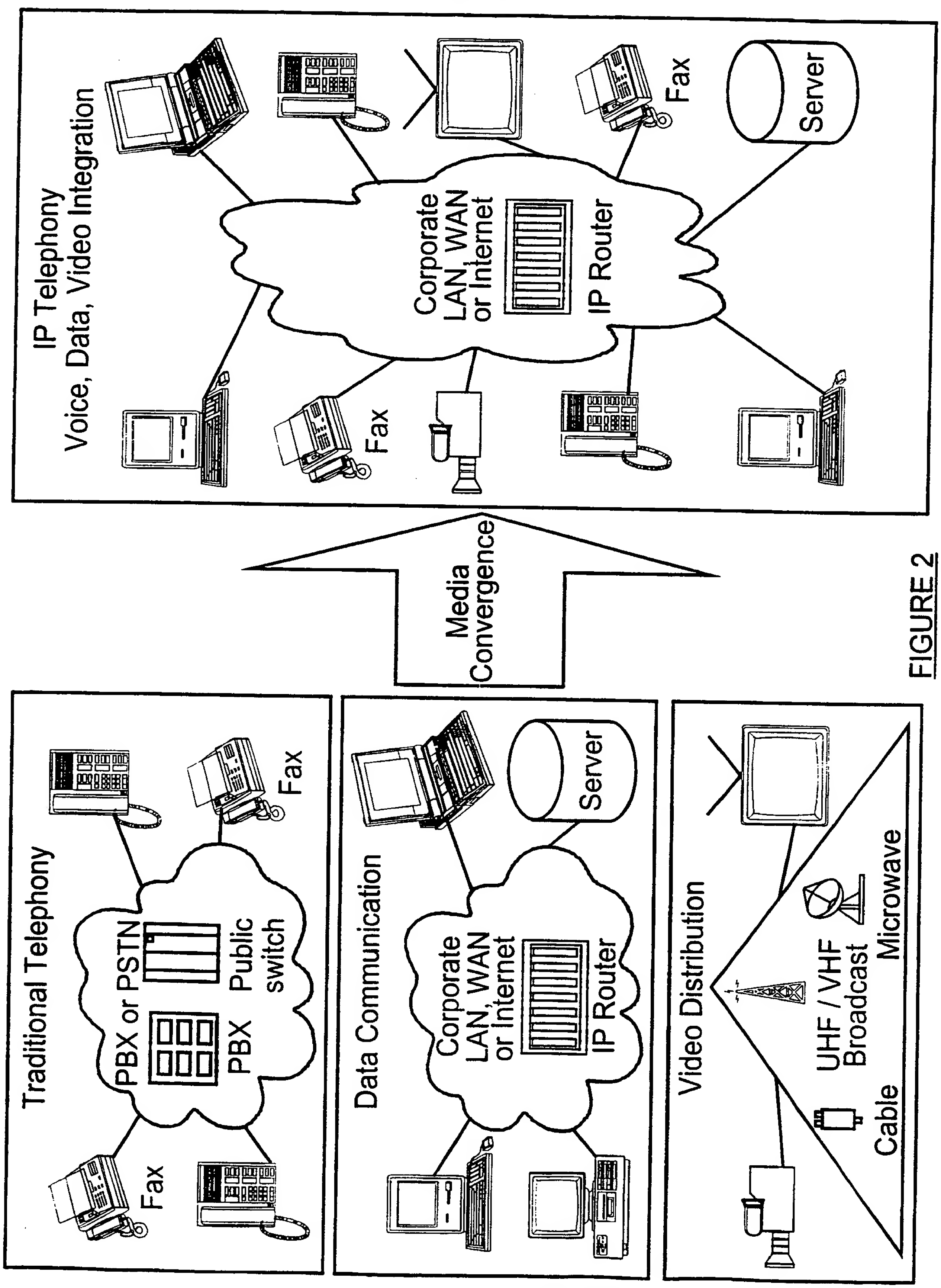
IP Telephony
Voice, Data, Video Integration
Corporate
LAN, WAN
or Internet
IP Router
Fax
Fax
Server
Media
Convergence
Traditional Telephony
PBX or PSTN
PBX
Public
switch
Fax
Fax
Data Communication
Corporate
LAN, WAN
or Internet
IP Router
Server
Video Distribution
UHF / VHF
Broadcast
Microwave
Cable

FIGURE 2

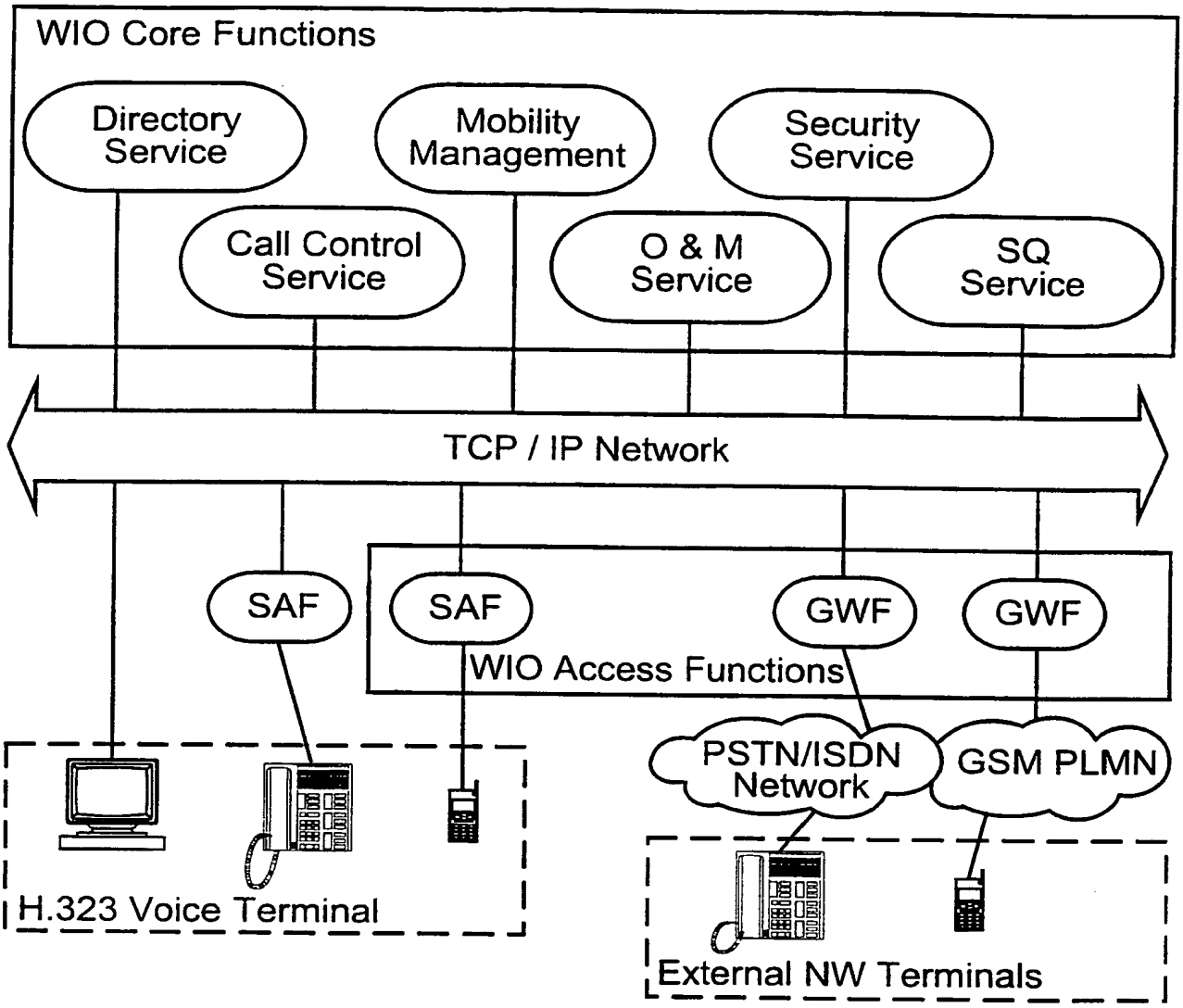

FIGURE 4

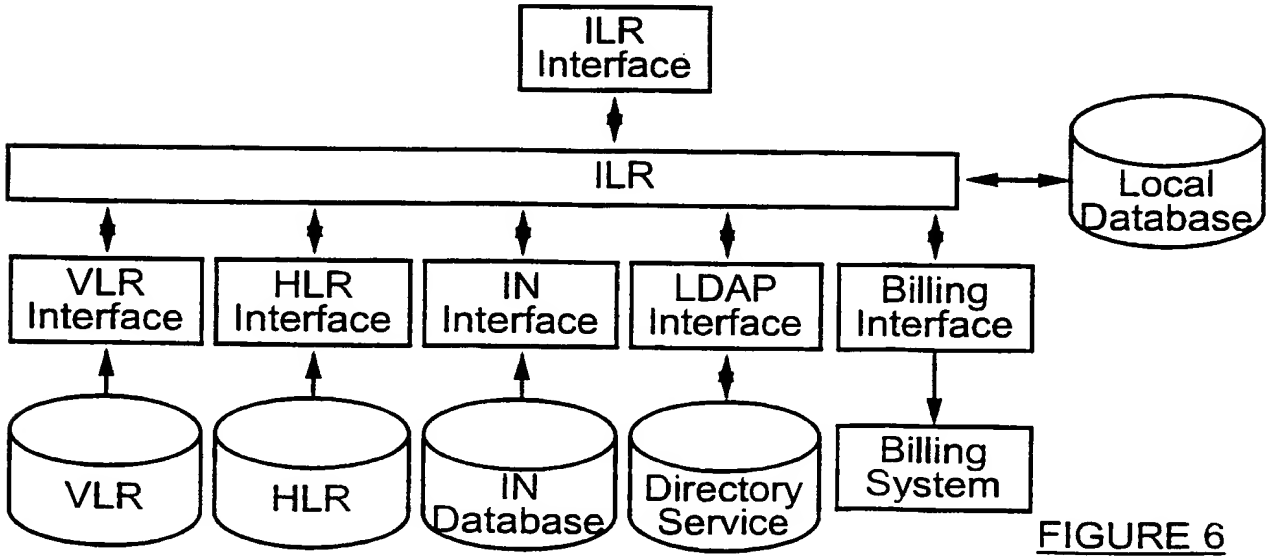

FIGURE 6

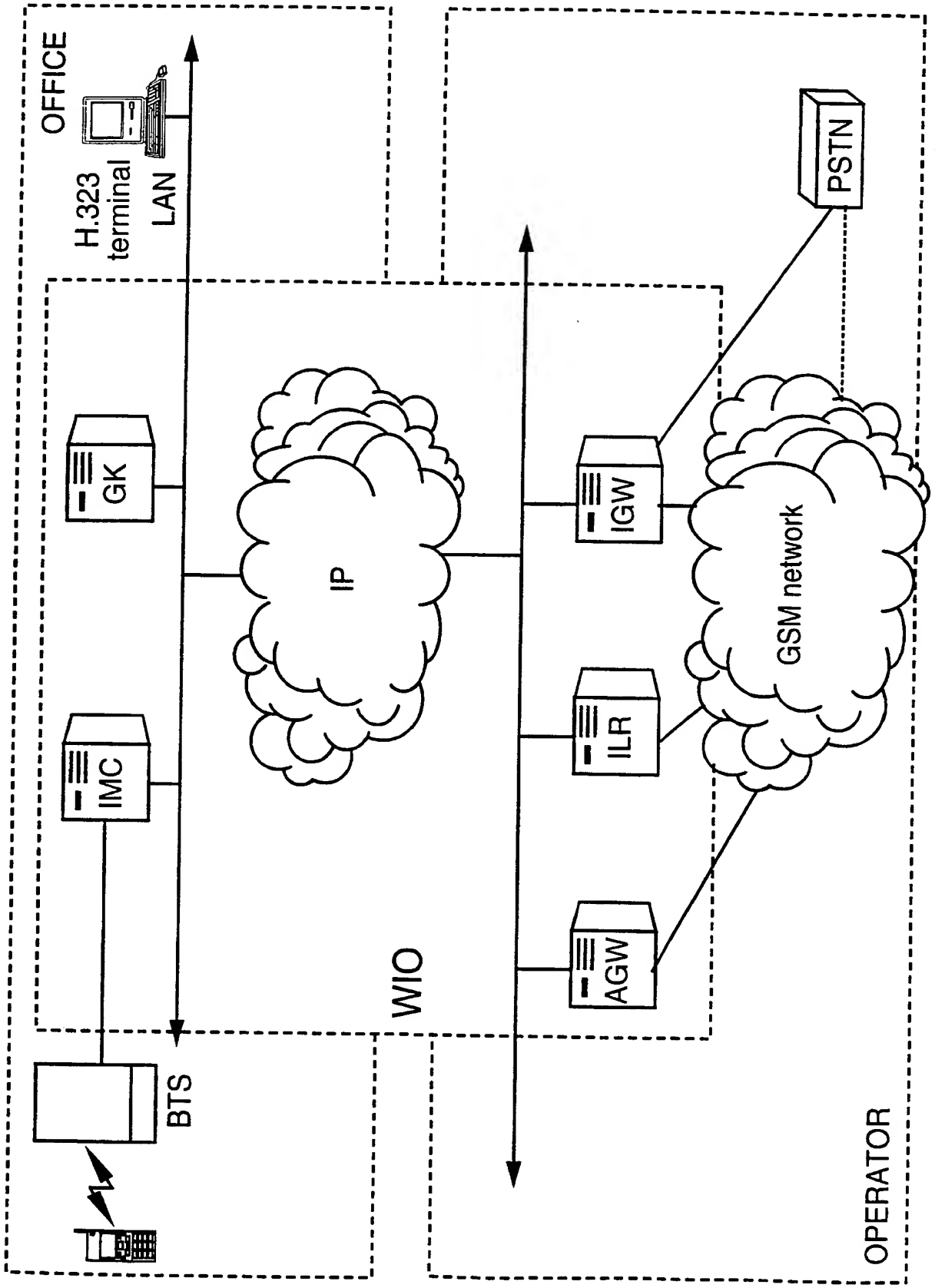
OFFICE
H.323 terminal
LAN
PSTN
GK
IP
IGW
GSM network
IMC
ILR
AGW
WIO
BTS
OPERATOR

FIGURE 5

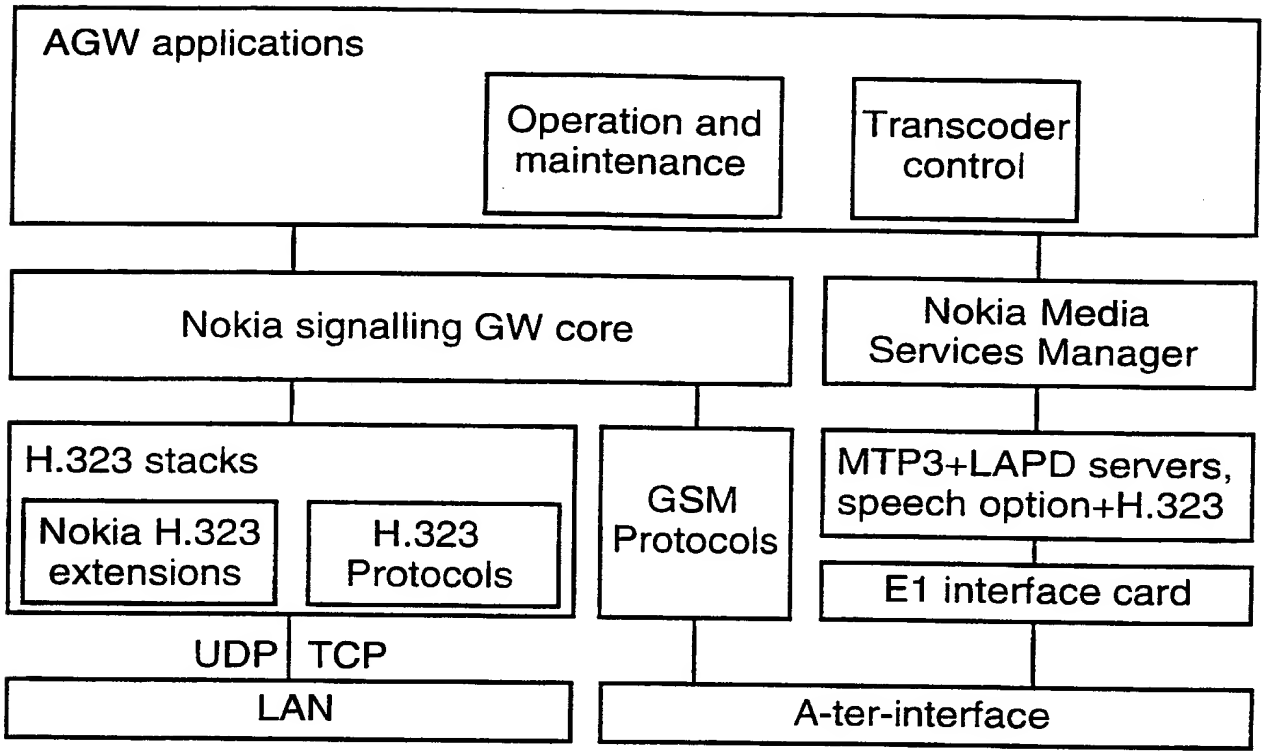

FIGURE 7

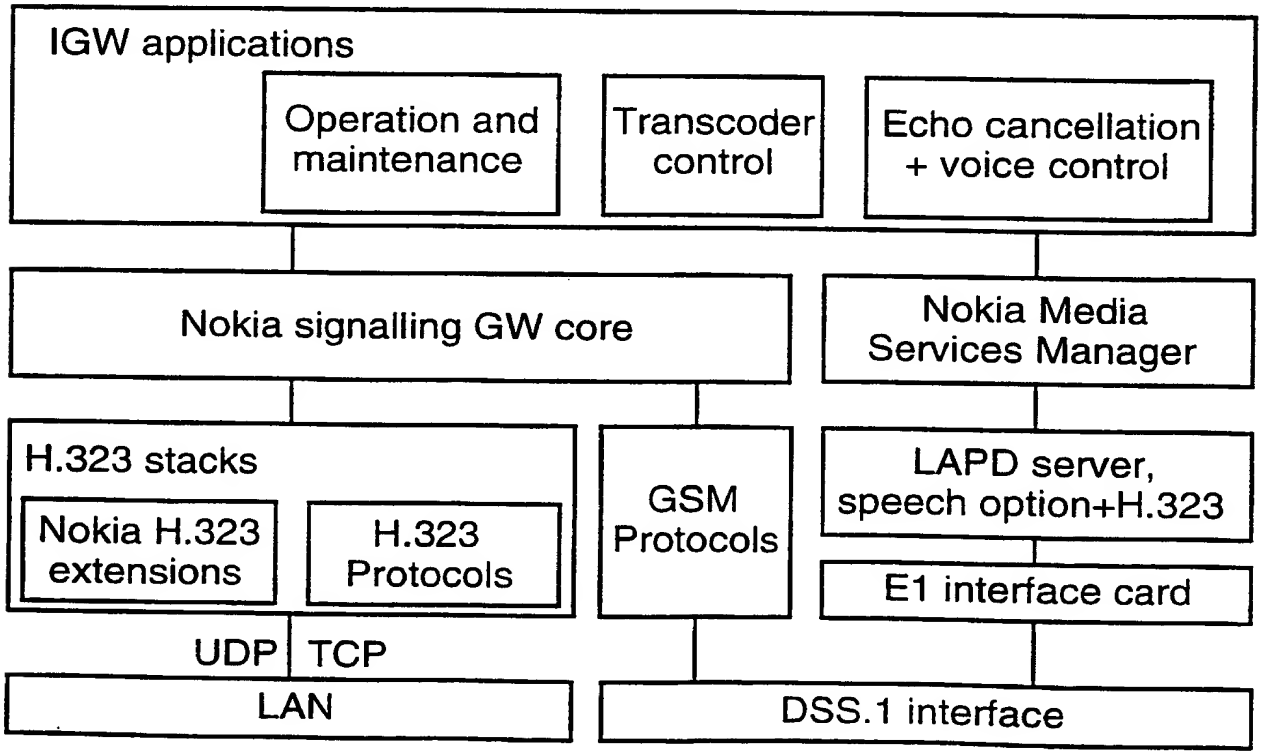

FIGURE 8

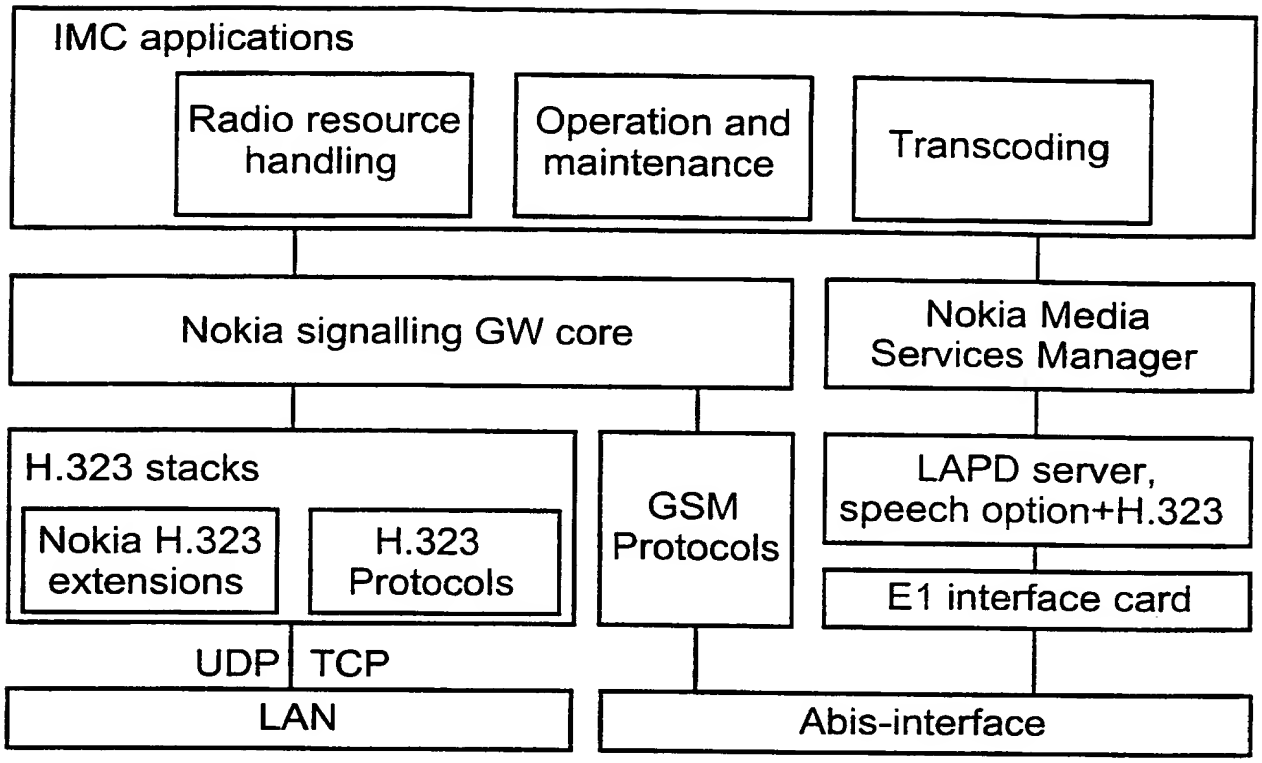

FIGURE 9

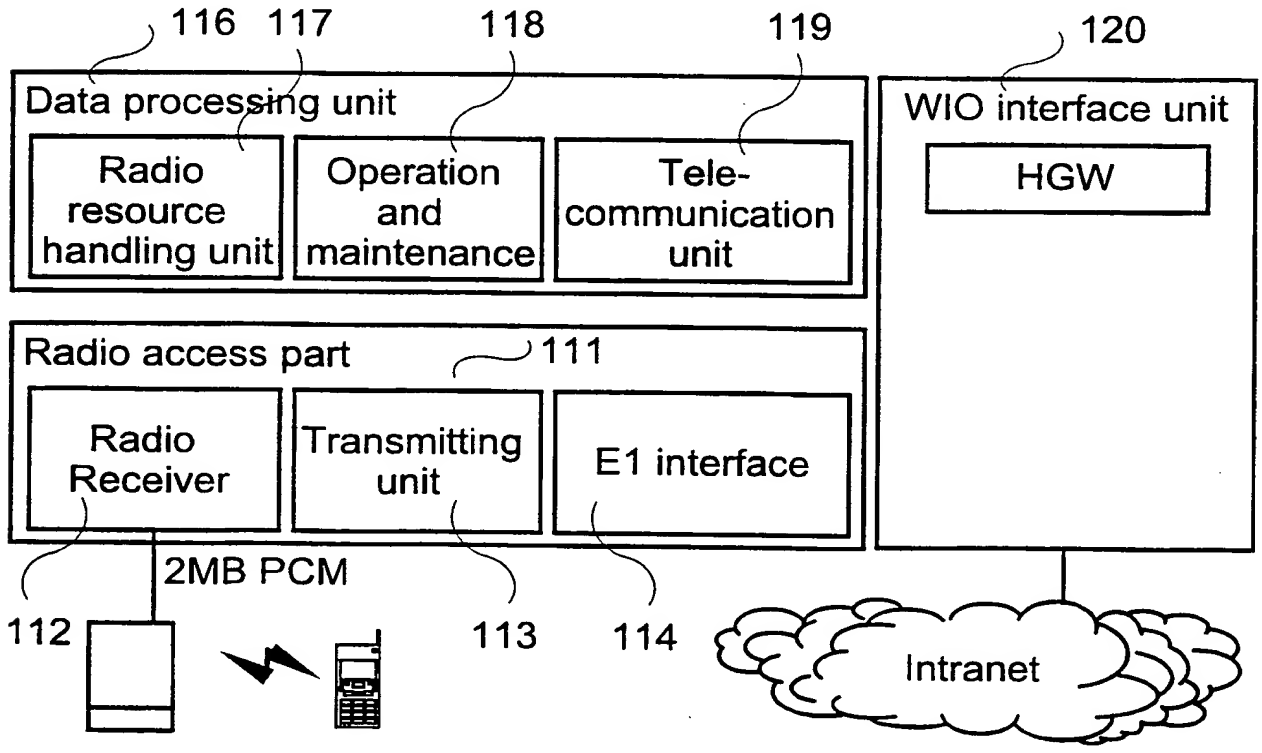

FIGURE 11

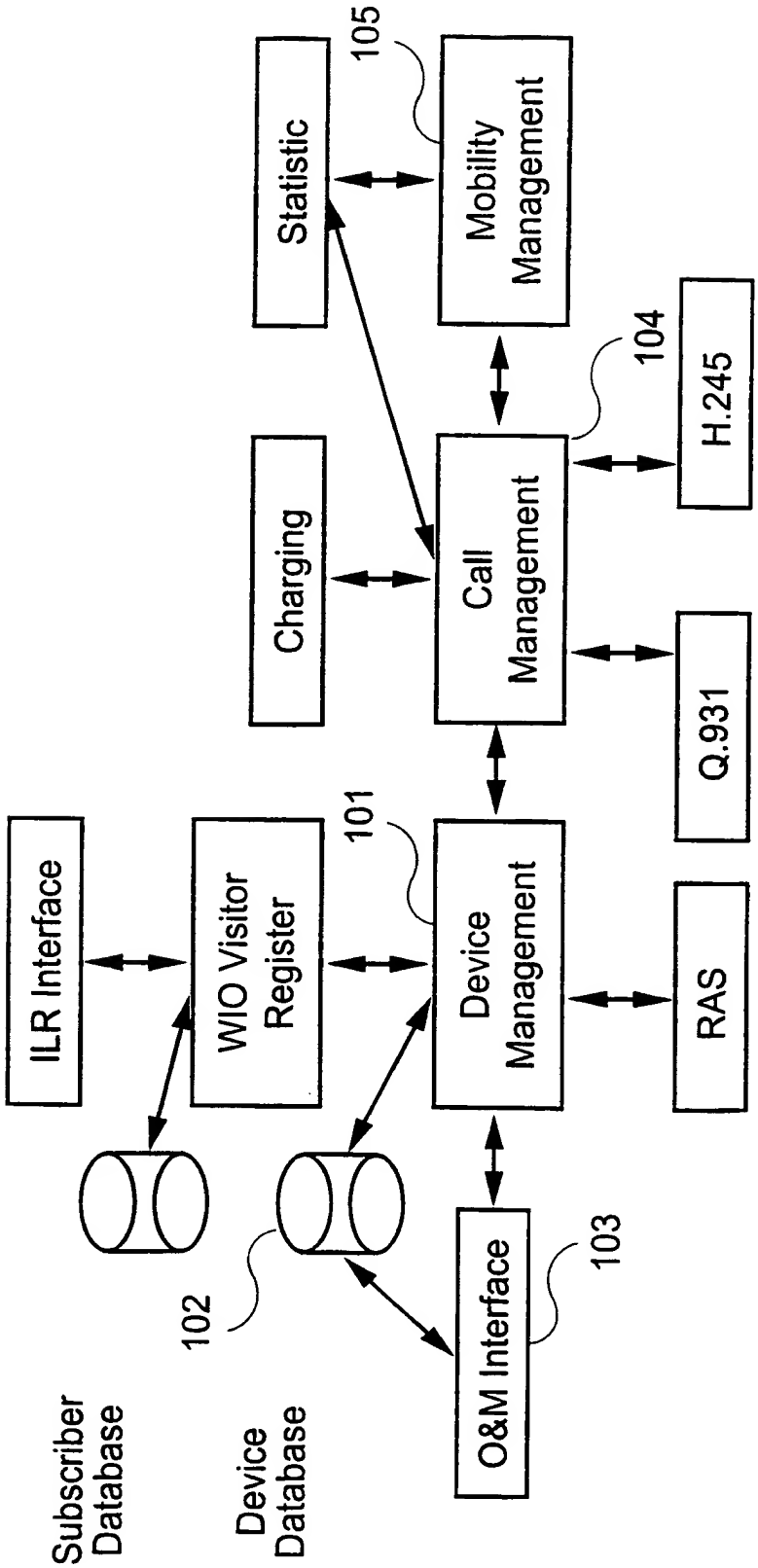
Statistic
105
Mobility Management
104
H.245
Charging
Call Management
Q.931
ILR Interface
WIO Visitor Register
101
Device Management
RAS
102
O&M Interface
103
Subscriber Database
Device Database

FIGURE 10

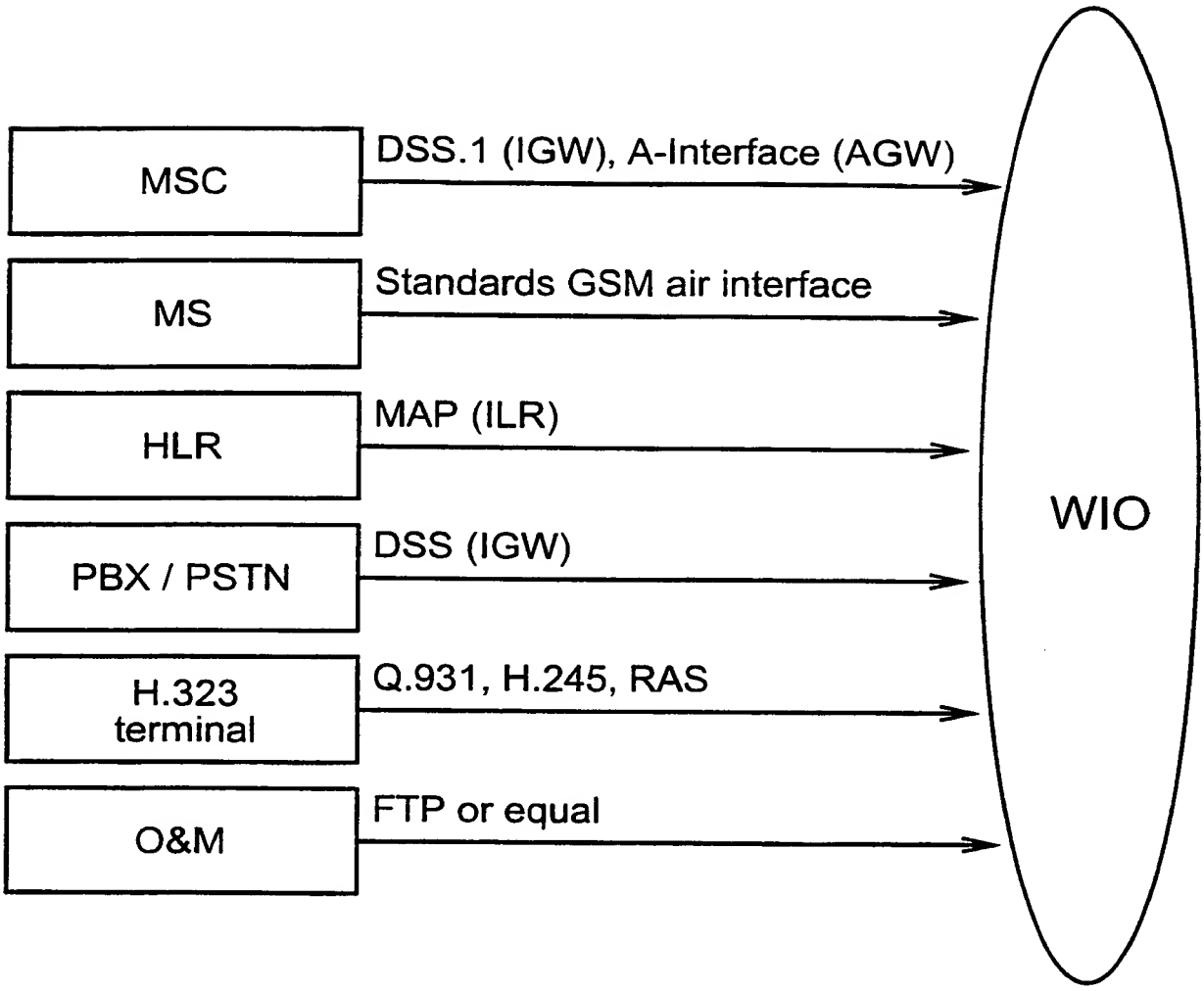
MSC
DSS.1 (IGW), A-Interface (AGW)
MS
Standards GSM air interface
HLR
MAP (ILR)
PBX / PSTN
DSS (IGW)
H.323 terminal
Q.931, H.245, RAS
O&M
FTP or equal
WIO

FIGURE 12

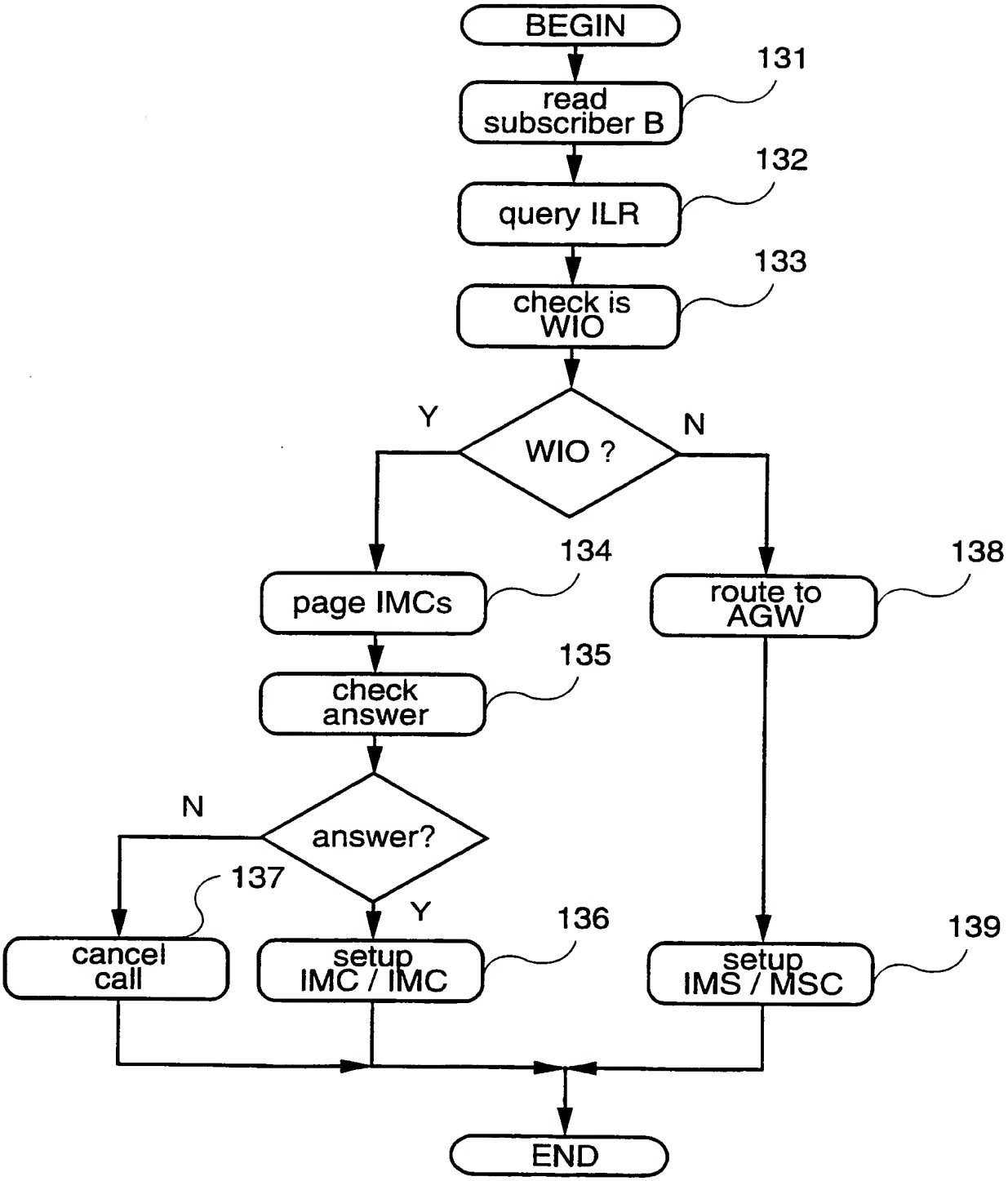
BEGIN
131
read subscriber B
132
query ILR
133
check is WIO
Y
WIO ?
N
134
page IMCs
138
route to AGW
135
check answer
N
answer?
137
Y
136
cancel call
setup IMC / IMC
139
setup IMS / MSC
END

FIGURE 13

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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H04Q 7/30

A3

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980615	19 March 1998 (19.03.98)	FI

(71) Applicants *(for all designated States except US)*: NOKIA TELECOMMUNICATIONS OY [FI/FI]; Keilalahdentie 4, FIN–02150 Espoo (FI). NOKIA MOBILE PHONES LTD. [FI/FI]; Keilalahdentie 4, FIN–02150 Espoo (FI).

(72) Inventors; and

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(74) Agent: JOHANSSON, Folke; Nokia Corporation, P.O. Box 226, FIN–00045 Nokia Group (FI).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.

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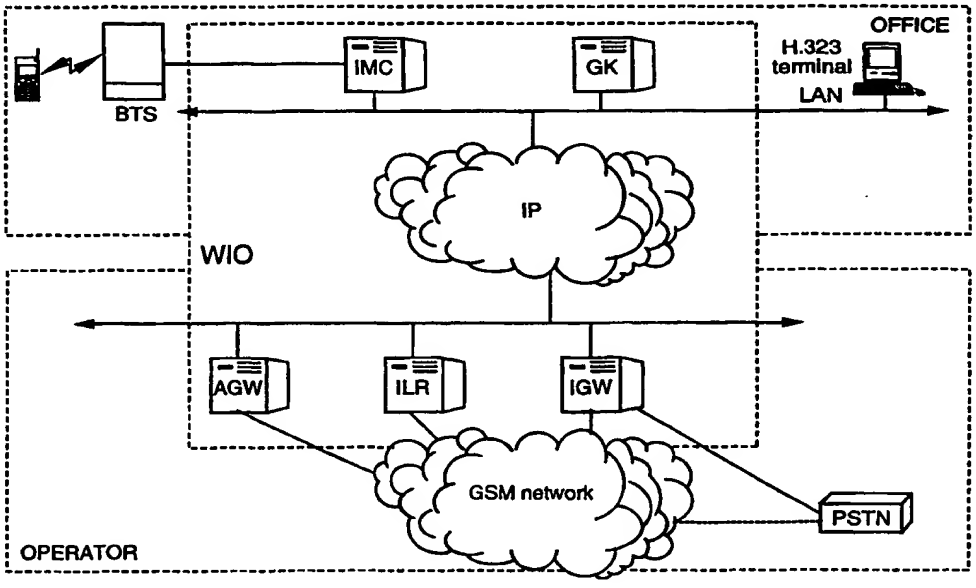
(88) Date of publication of the international search report:
04 November 1999 (04.11.1999)

(54) Title: A METHOD AND SYSTEM FOR ROUTING A CALL BETWEEN CELLULAR SUBSYSTEMS



(57) Abstract

A communication system, comprising a network switching system (MSC) and in addition to a conventional subsystem (BSS) comprises a second subsystem (WIO, BTS) accessible by a first group of mobile subscribers of the communication system. Said second subsystem comprises means (ILR, GK) for mapping a number identifying a mobile subscriber in the communication system to a network address of the second subsystem (WIO, BTS) when the mobile terminal of the mobile subscriber is able to communicate with a base station (BTS) of the second subsystem (WIO, BTS).

PATENT COOPERATION TREATY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference AK/14270WO	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/FI 99/00214	International filing date *(day/month/year)* 18 March 1999	(Earliest) Priority Date *(day/month/year)* 18 March 1998
Applicant Nokia Telecommunications Oy et al		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

[x] It is also accompanied by a copy of each prior art document cited in this report.

1. [ ] **Certain claims were found unsearchable** (See Box I).

2. [ ] **Unity of invention is lacking** (See Box II).

3. [ ] The international application contains disclosure of a **nucleotide and/or amino acid sequence listing** and the international search was carried out on the basis of the sequence listing
   - [ ] filed with the international application.
   - [ ] furnished by the applicant separately from the international application,
     - [ ] but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
   - [ ] transcribed by this Authority.

4. With regard to the **title**,
   - [ ] the text is approved as submitted by the applicant.
   - [x] the text has been established by this Authority to read as follows:

     A method and system for routing a call between cellular subsystems

5. With regard to the **abstract**,
   - [x] the text is approved as submitted by the applicant.
   - [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is:

   Figure No. 5
   - [x] as suggested by the applicant.
   - [ ] because the applicant failed to suggest a figure.
   - [ ] because this figure better characterizes the invention.
   - [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 99/00214

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/30
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9533348 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 7 December 1995 (07.12.95), page 17, line 14 - line 25; page 19, line 9 - line 39; page 21, line 24 - line 32, page 22, line 5 - line 15; page 22, line 21 - page 23, line 12; claims 1, 8	1-3,7-11,14, 16-18
A	GB 2269723 A (SOCIETE D'APPLICATIONS GENERALES D'ELECTRICITE ET DE MECANIQUE SAGEM), 16 February 1994 (16.02.94), page 4, line 2 - page 5, line 4, abstract	1,9,14,18
P,A	GB 2322040 A (NOKIA MOBILE PHONES LIMITED), 12 August 1998 (12.08.98), page 2, line 3 - line 14	1,9,14,18

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 Sept 1999	15 -09- 1999
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Jaana Raivio/MN Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

30/08/99

International application No.
PCT/FI 99/00214

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9533348 A1	07/12/95	AU 692880 B	18/06/98
		AU 2686495 A	21/12/95
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		CN 1150511 A	21/05/97
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GB 2269723 A	16/02/94	DE 4324094 A	17/03/94
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		GB 9702290 D	00/00/00
		JP 10257155 A	25/09/98